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DISLOCATION OF VERTEBRÆ IN LOWER CERVICAL REGION, FOLLOWED BY SYMPTOMS OF COMPLETE SEVERANCE OF THE SPINAL CORD; LAMINECTOMY; LATER PARTIAL RESTORATION OF FUNCTION.*

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CASE HISTORY.—Fred. M., twenty-two years of age, a healthy, athletic young man, after diving into shallow water, July 4, 1905, became semi-unconscious and devoid of power over his arms and legs. A masseur, who was present when he was removed from the water, asserted that when he then examined him there was a dislocation of the spine in the cervical region which he reduced on the spot by manipulation. Four hours later he was received at the Buffalo General Hospital, in the following described condition:

There exists total paralysis of both legs; the arms and hands are partially paralyzed. Speech, eyes, pupils and facial muscles are not affected; the head is slightly retracted, but moves in all directions, with some pain, however. A careful examination of the spinal column does not reveal any fractures or dislocations. There is some tenderness about the spinous process of the fifth cervical vertebra, also some indefinite pain about the third thoracic

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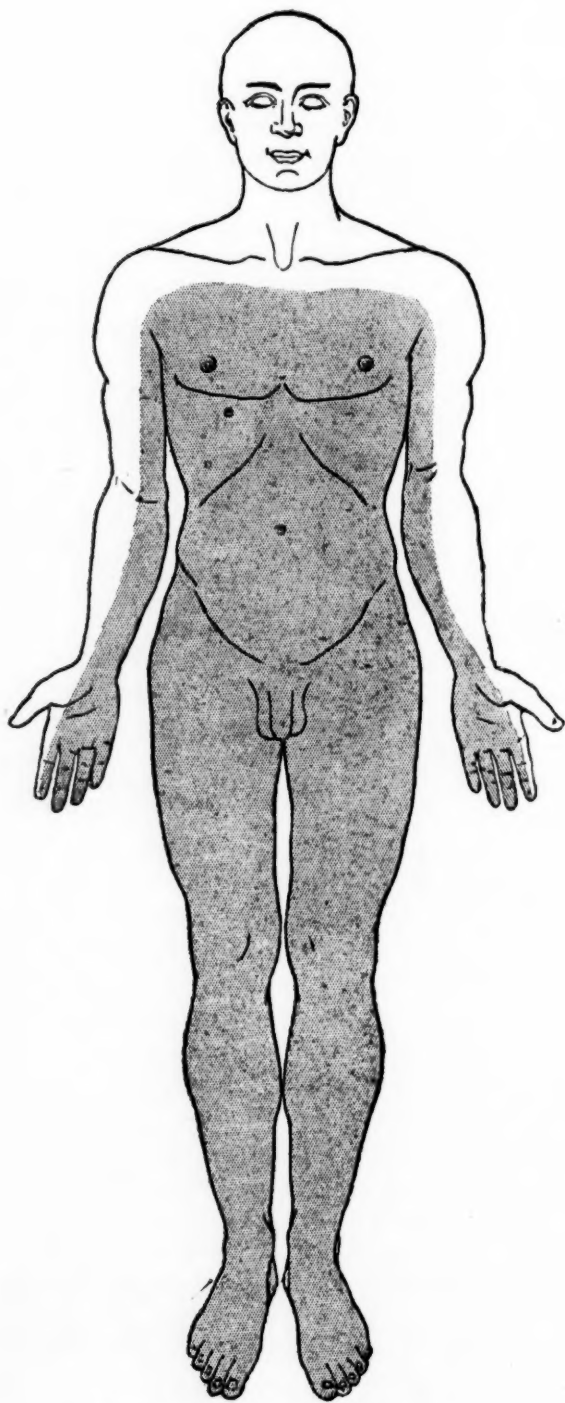


FIG. 1.—Area of total paralysis of sensation.

spine. The pulse is slow, but full, regular and of good tension. The heart is normal; no temperature.

The patellar, ankle and plantar reflexes are absent. Marked priapism is present; catheterization is necessary. The patient is able to flex the arms but not to extend them. He was transferred to the surgical ward, in charge of Dr. William C. Phelps, with whom I saw him on the following day, July 5, 1905.

Examination shows him to be a man five feet eight inches in height, weighing 150 pounds; muscles well developed; offering no scars, contusions or discolorations of any kind on his head or body. There is absolute loss of motion of the trunk and legs; limited motion of the arms, and rather free motion of the head, but attended with pain. He lies with head somewhat retracted because of relief from an aching pain when the head is flexed. As he lies on his back, the respiration attracts attention, in that there is no chest expansion, no movement of the thorax whatever in inspiration or expiration. On the contrary, the abdomen is unusually active in respiration, showing the well-marked characteristics of abdominal or diaphragmatic breathing; thoracic breathing is absolutely wanting. Extreme priapism, causing the patient considerable pain and inconvenience, is present; the head and face offer nothing abnormal. The dorsum of neck about the fifth and sixth cervical region is painful to pressure, but no crepitus or deformity of any kind is discoverable; the spine caudad of the painful area is normal.

The Arms; Motion.—Movements of the thumb and fingers are impossible. Extension and flexion of the forearms are possible but greatly weakened. Adduction of the arm, pronation and supination of the forearm are very weak. There is considerable weakness of the deltoids, biceps, triceps and chest muscles; also the muscles about the scapula, which has the appearance of the "winged scapula," due to paralysis of the serratus magnus. Triceps and biceps tendon reflexes are absent.

Sensation.—There is a zone of anæsthesia corresponding to the level of the second intercostal space ventrally, limited to the ulnar side of the arm and forearm, including the middle, ring and little fingers (Fig. 1). The thumb and forefinger only give normal sensation. The limitation of anæsthesia affects both arms symmetrically, and is for both temperature and tactile senses. The abdomen is tense; the abdominal reflex is lost; likewise the

cremasteric. Priapism noted, makes catheterization painful. There is involuntary discharge of feces.

The Legs.—Absolute loss of motion; not even the toes respond.

Sensation.—Anæsthesia is present.

Reflexes.—The patellar tendon reflexes are not obtainable even with Jendrassik's method. Achilles tendon reflex and Babinski's sign are absent; likewise the plantar reflexes.

The general condition of the patient is good. Eats well, sleeps fairly good, no pain; no temperature; pulse 85; heart and lungs are normal.

The patient was immediately placed on a water-bed and extension applied to the head.

Diagnosis.—The complete paralysis of the legs, partial paralysis of the arms, and loss of all reflexes, together with the area of anæsthesia, led to a diagnosis of complete severance of the cord. The painful area over the fifth and sixth cervical spinous processes, together with involvement of the posterior thoracic or respiratory nerves of Bell, the phrenic nerves remaining intact, pointed to involvement of the cord at the level of the sixth cervical vertebra. An operation was suggested, but denied if absolute recovery could not be promised.

During the next few days the condition remained about the same; bed-sores began to develop on the sixth day, and a mild degree of cystitis appeared. The incontinence of feces and priapism persisted, the latter under the continual use of ice and camphor monobromate subsiding partially. Reflex contractions in the feet and legs appeared, and the patient experienced darting pains in the arms and legs. The condition remaining the same as regards motion, sensation and the sphincters, his strength failing, bed-sores growing larger, and the cystitis more pronounced, a most urgent demand was made for an operation if the young man's life were to be saved. The mother reluctantly consented, and the patient was transferred to the care of Dr. Roswell Park, whose report follows:

"July 22, 1905, under chloroform, I exposed the spine between the fourth cervical and first dorsal, finding the sixth cervical apparently somewhat loosened and abnormally movable, but without fracture so far as I could discover. I removed the posterior arch of the sixth and exposed the spinal canal. Outside the dura

nothing appeared abnormal. Upon puncturing the dura a large amount of cerebrospinal fluid escaped with a jet, showing that intraspinal tension had been very much increased. After opening the dura for one inch, the cord itself showed no particular evidence of laceration or violent disturbance, but seemed to have shrunk; was flattened so that it did not nearly fill the canal. There was a small remnant of old clot within the dura. On lifting the cord with an artery needle, it seemed flattened, ribbon-like, shrunken and to lack in bulk. I could find no evidence of present displacement of the vertebræ, and examination above and below indicated that the spinal canal was ample and afforded sufficient accommodation for the cord. I closed the dura with catgut and the entire wound with buried and superficial drainage.

"The wound healed kindly. Patient remained in the hospital about four weeks and went home, showing some improvement, able to move the feet a little, and with considerable improvement in sensation. In the hands and arms not much change appeared."

The patient remained in the hospital until August 18, 1905, gaining somewhat in strength; the bed-sores had healed, the cystitis disappeared, and he was able to sit up in a roller-chair. A small fistulous opening in the operation field was still present.

His condition is as follows: With exception of the fistula, the wound has healed by first intention. He experiences no pain about the head or neck and can move the head freely. The area of anæsthesia has not changed materially; if anything it is more of a hypæsthesia. He can now feel the contact of a pin, but cannot distinguish between the sharp and dull point; temperature sense still disturbed. He has fields of hyperæsthesia located in the legs, on the soles of the feet, and on the left knee.

Motion.—He is able to raise the arms over his head, can flex the forearms, and has fairly good extension of the hand, but the flexors of the hand are weak; likewise pronation and supination. He can draw up the right leg as far as the left knee; extension and flexion of the right foot is quite strong. The left leg can be drawn up to about the middle of the right leg. Extension and flexion of the left foot present, but very weak. He has better control over the legs when lungs are inflated.

Reflexes.—The patellar tendon reflexes are markedly exaggerated. Ankle and patellar clonus present; likewise exaggerated plantar reflexes and Babinski's. The abdominal reflex

also the cremasteric are still absent. The priapism has disappeared, and he can tell when bowels and bladder are to act, but cannot control the sphincters. The breathing remains the same, being entirely diaphragmatic. Involuntary contraction of the muscles of the legs and spasmodic flexion of the legs and feet annoyed him greatly.

With directions for further treatment, he was allowed to go to his home in Wellsville, N. Y., and was placed under the care of Dr. G. H. Witter. Reports from time to time showed continuous improvement, so that in his roller-chair he was able to go back to the office, and in a small way resume his work as telegraph operator.

On April 17, 1906, he returned to the hospital for observation and treatment.

Stature.—He inclines slightly forward, but can stand for fifteen minutes without support. Romberg is slightly present. Can flex right leg upon thigh and upon pelvis, standing on left leg, but can lift left leg only three inches from floor standing on right leg.

Gait.—He is able to walk when supported, or when pushing a chair as a guide. If he could control the tendency to fall backwards, he could walk easily with a cane. The gait is spastic; he is able to lift the right leg from the floor in walking, but drags the toe of the left foot. The left leg is considerably weaker than the right. In bed he is able to draw up the right leg freely, but barely able to draw up the left. On sitting without support, he is obliged to balance the body with his feet to prevent falling backward. He says his back is the weakest part and arches out to a great degree if not supported. He has all the motions of the arms and shoulders freely.

Forearms.—Pronation and supination are good; likewise the extension of the wrist. He closes the right hand fairly well, and can write very easily and use the telegraph key with force. Dynamometric test, repeated trials, averages 30.

Left Arm and Hand.—Incomplete pronation and supination of forearm are present. He can open and close the hand but without much power. Dynamometric test, repeated trials, averages 10.

He began to use the telegraph key on November 1, 1905,

using the wrist instead of the fingers. About March 1, 1906, he telegraphed easily and sent 5000 words over the wire.

Circumference.	Right Arm.	Forearm.	Left Arm.	Forearm.
Upper third,....	10 inches.	9¼ inches.	9¾ inches.	8¾ inches.
Middle third,...	9 inches.	7½ inches.	8¼ inches.	7 inches.
Lower third,....	8¼ inches.	5¾ inches.	7½ inches.	5½ inches.

Faradic irritability of the right and left arms and legs is well preserved. There is no marked difference between the two sides.

Reflexes.—The tendon reflexes of the triceps, biceps and forearm muscles are exaggerated. Muscle reflexes are also heightened. The abdominal and cremasteric reflexes are absent. The tendon reflexes of the legs are all exaggerated—patellar, achilles; Babinski's sign can be elicited by simply touching the soles of the feet. Patellar and ankle clonus are present and the plantar reflexes are unusually active.

Sensation.—There is still some difference of sensation at the level of the original zone; a mild degree of hypæsthesia still exists. In the left leg, temperature and tactile sense are normal, but in the right leg, although the patient can feel the condition of the leg and foot as to being warm and cold, he cannot distinguish between hot and cold applications to the leg. Tactile sense is normal. Breathing is still diaphragmatic. The bowels are constipated, bladder functionates normally and priapism has long since disappeared. The scar, five inches in length, extends from the third cervical to the second thoracic vertebra. The spinous processes of these vertebræ are gone.

The subject of severe injury to the cord through fracture, gunshot or other insult, has received considerable attention during the past few years, and was a topic of general discussion at the 1905 Meeting of the American Surgical Association. It seems to be agreed that however severe the lesion, even to complete severance of the cord, surgical measures should be resorted to as soon as possible. The symptoms of complete severance of the cord as stated by Thomas¹ are:

1. Complete paralysis, usually of a flaccid type.

2. A complete loss of sensation in all its forms.
3. Absent reflexes, especially the knee jerk, while the plantar reflex, on the contrary, is often retained.
4. Complete paralysis of the bladder and rectum, with priapism.
5. Vasomotor paralysis, with severe sweating in the paralyzed parts.
6. And most important absence of variations in the symptoms.
7. Absence of irritative phenomena, such as pain.

Walton² in a comprehensive paper on "Spinal Fracture with special reference to the question of operative interference," arrived at the following conclusions:

(1) There are no symptoms which establish (otherwise than through their persistence) irremediable crush of the cord.

(2) While total relaxed paralysis, anæsthesia of abrupt demarcation, total loss of reflexes, retention, priapism and tympanitis, if persistent, point to complete and incurable transverse lesion, the onset of such symptoms does not preclude a certain degree at least of restoration of function.

(3) The prognosis without operation is grave.

(4) While the results of operation are not brilliant, they are sufficiently encouraging to warrant us in making the practice more general.

(5) In most cases it will be wise to operate within a few days of the injury, but a delay of some hours is advisable, partly on account of shock and partly to eliminate the diagnosis of simple distortion.

(6) We have no infallible guide to the extent of the lesion. The operation at the worst does not materially endanger life nor affect unfavorably the course of the case, and may at least reveal the lesion and lessen the pain; it may sometimes save a patient from death or from helpless invalidism of most distressing character. Instead of selecting the occasional case for operation, we should rather select the occasional case in which it is contraindicated (the patient with great displacement

of vertebræ, the patient with high and rising temperature, the patient plainly moribund, the patient still under profound shock).

(7) The dura should be opened freely; it need not be sutured; drainage is not necessary.

Burrell³ in a summary of all the cases of fracture of the spine which were treated at the Boston City Hospital from 1864 to 1905, states his conclusions as follows:

1. That fractures of the spine may well be divided into two classes: first, fractures of the spine with injury to the cord; and second, fractures of the spine without injury to the cord.

2. That it is not best to decide what the treatment of an individual case of fracture of the spine should be from the statistics, because the lesion varies so widely.

3. That in many cases of fracture of the spine it is impossible to primarily state whether the cord is crushed or pressed upon by bone, blood or exudate except by an open operation.

4. That only by the persistence of total loss of reflexes, complete insensibility to touch and pain, and motor paralysis below the level of the lesion can total transverse destruction of the cord be diagnosticated.

5. That if pressure on the cord is allowed to remain for many hours, irreparable damage to the cord may take place.

6. That unless it is perfectly clear that the cord is irreparably damaged, an open operation to establish the condition of the cord and to relieve pressure is imperative as soon as surgical shock has been recovered from.

7. That in certain cases of fracture of the spine, when the cord is not injured, but is liable to injury from displacement of the fragments of a vertebra, rectification of the deformity and fixation of the spine may be used.

8. That if the cord is crushed, no matter what treatment is adopted, there will, of necessity, be a high rate of mortality.

There is no question but that a complete transverse lesion was present in the case reported, by the appearance of the cord as found by Dr. Park and by the symptoms and their persistence up to and following the operation, fifteen days after the

injury. That a very decided regeneration of the cord has taken place, with a remarkably excellent result, is evidenced by his condition as stated at the present time.

In the Stewart-Harte case, the operation was performed three hours after the injury, a gunshot wound completely severing the cord, and regeneration did occur.

Fowler⁴ in his paper in the symposium of spinal-cord lesions, reported a case in which a bullet-wound was received at the tenth and eleventh thoracic segments, completely severing the cord, in which an operation was performed and the cord sutured ten days after the operation. Regeneration of the cord followed and a partial recovery of the patient has taken place.

A timely experimental investigation of the occurrence of traumatic degeneration and regeneration of the spinal cord has been recently made by Fickler,⁵ who experimented on the lower animals. As the result of the study of the process of regeneration in the spinal cord, Fickler notes the following:

"The regenerative phenomena following experimental lesions of the cord in animals are not as marked as those following compression of the cord in human beings. Section of the white substance between the anterior horns and the periphery is followed by regeneration of reserve fibers above and below the plant of section. A regeneration of ganglion cells in the cord has not yet been observed. Regeneration of nerve fibers occurs in many diverse diseases of the cord, whether the disease has already run its course or whether it is slowly developing; it occurs in traumatisms, compressions, syringomyelia, and in transverse and disseminate myelitis. It does not occur in the columnar degenerations and in multiple sclerosis. In order that regeneration may occur it is necessary that the ganglion cell should be intact. The first evidence of regeneration is seen one week after the section, and the process proceeds slowly. Only a comparatively small number of fibers are restored. The functional result is not a very considerable one. The best conditions for a restoration of function in the anterior part of the cord are afforded by compression, which leaves intact the central veins and the general configuration of

the cord. A regeneration proceeding from the posterior roots in compression has not yet been found, and probably, cannot occur, since the cause of injury of the cord is a caries of the vertebræ, which causes tuberculous ulceration of the ganglia on the posterior roots, in which case no regeneration can occur."

This case is a notable one. First, because the injury undoubtedly was a dislocation of the sixth cervical vertebra, according to the report of the masseur and the loosened condition of the sixth cervical vertebra as noted by Dr. Park at the operation; second, that a crushed or pinched condition of the cord followed, as adduced by the condition of the cord at the operation, which was borne out by the clinical symptoms, answering to all the tests of a complete transverse severance of the cord; third, that a regeneration of the spinal cord followed the operation, accompanied by a descending degeneration of the cord; fourth, and that a remarkable recovery of function took place, although the operation occurred fifteen days after the receipt of the injury.

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THE OMENTUM AND ITS FUNCTIONS.

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THE concept of the omentum in the minds of most of our writers has been incompletely stated, the anatomist having the most to say in his descriptions of its various folds. Until recent years but few accurate observers have endeavored to describe its structure or numerous functions. A detailed study of this tissue brings to light many researches which give evidence of its great importance in the protection of the peritoneal cavity. It is impossible to discuss this organ apart from the conditions of the general peritoneal surface; nevertheless, owing to its histo-anatomy being somewhat distinctive, its functions are, to a certain extent, unique.

Embryology.—By the end of the first month of fetal life the digestive tract is formed, consisting of but a single tube; a dilatation in the upper part of which becomes the future stomach. This dilated portion is situated in the future thoracic cavity; has two attachments, known respectively as the anterior and posterior mesogastros; the posterior curvature becoming more pronounced than the anterior. Just below the stomach, in the third week, a rudimentary liver evaginates into the anterior mesogastrium, and in the fourth week, the pancreas into the posterior. The position of the pancreas and its early attachments to the mesial line determines the fixation of the duodenum, which is the first part of the intestinal tract to become fixed. In the meantime, the stomach descends toward its future normal position, rotating at the same time, so that what was the posterior border becomes the inferior, and the anterior, the superior. The posterior mesogastrium becomes redundant, out of proportion to the requirements of its visceral connections, and, to some extent, independent of the

direct mechanical purpose of carrying blood-vessels to the viscera.⁶

The growth of the spleen carries the attachment of this membrane to the left. The posterior, or right surface of the mesogastrium, forms the cavity which is known as the cavity of the lesser omentum.

At, or soon after, birth there is a cohesion of the posterior layer of the omental fold with the transverse mesocolon. By this cohesion the pancreas becomes covered and the buried peritoneal surfaces absorbed, areolar tissue taking its place. Through this, the transverse colon seemingly becomes a part of the descending layer of the omentum.

Anatomy.—Another entirely different view of the omentum is obtained from the study of general anatomy. From time immemorial, and practically without any alteration in detail, anatomists have contented themselves with a description of the omentum as being “a complicated folding of the peritoneal surfaces,” submitting careful descriptions of the several layers with their origin.

The omentum is a reticulation of connective tissue, carrying a double fold of peritoneal membrane, extending from its parietal attachment on the posterior abdominal wall, down more or less deeply into the abdomen, then up to become attached to the lower portion of the stomach and gastro-splenic ligament. The retrogastric space, which includes the space between the folded peritoneum not obliterated by adhesions of its surfaces, is known as the cavity of the greater omentum. Its connection with the general cavity is at the right of the stomach in foramen of Winslow. This cavity varies in size; in childhood extending down into the fold of the omentum; or, owing to adhesive obliteration of the lower sac in adults, or absorption, this cavity often does not extend much below the lower margin of the stomach.^{2, 6, 17}

The omentum possesses a remarkable vascular supply; its arteries coming from the gastro-epiploic, right and left; its veins empty into the portal vein. No nerves have been demon-

strated; nevertheless, vasculomotor and trophic nerves must exist to innervate the different structures contained.

The lymph-stream is abundant and empties into the glands on the greater curvature of the stomach; in some cases fifteen or more may be seen. The majority are found between the greater curvature and the transverse colon, although some may extend below the lower border of the colon.^{9, 16} The lymph-stream, after it passes the first chain of glands, empties into the retroduodenal, and from there into the receptaculum chyli.¹⁴

According to A. S. Warthin, hæmolymph glands of the splenic type are found, their position not being stated.²¹ Melissinos, however, says that they are more numerous between the spleen and greater curvature of the stomach.

According to Robinson, many times in a hundred autopsies the omentum is entirely out of sight, rolled up above or under the transverse colon. In 10 per cent. of the cases it may cover the cæcum, and in 20 per cent. reach into the pelvis. It tends chiefly to the left and is found in 3 per cent. of all the herniæ.¹⁸

The position of the omentum in the abdomen is determined in part by the pumping action of respiration, intra-abdominal pressure, or more largely by the peristaltic movements of the intestines. By means of the latter, the omentum is kept unfolded, and is drawn to different parts of the abdomen with the movements of the intestines, so that each portion of the peritoneal cavity is touched at times by this membrane. The descensus of the same into the abdomen will depend not only on its length, but upon the position of the lower border of the stomach.

Histology.—The ground substance of the omentum is composed of connective tissue made up of a variable amount of fibers, white and elastic. The white fibers are arranged in a reticular manner, connecting with each other. The meshes of the reticulation are occupied by the ground substance of the membrane, bridged over by the flattened cells of the surfaces. These meshes may become open in many parts owing to absorption of the intervening ground substance and the perforation of the cells covering it.¹⁷

Klein says that in those animals in which the omentum is fenestrated in the adult condition it is not, or only imperfectly so, in the young condition, being then a continuous membrane composed of a layer of connective-tissue bundles. This fenestration is produced by cavities appearing between the connective tissue bundles, which cavities open through the interstitial cement substance of the surface endothelium. A direct transition of connective tissue corpuscles into endothelial cells of the surface is hereby established.⁸ Lying upon these bundles of fibrous tissues are connective tissue nuclei or corpuscles. The corpuscles here and elsewhere belong to the fibrous tissue, and when separated from them, the bundles suffer in nutrition, and are extremely liable to die. Along with the bundles of fibers are intimately bound up arteries and veins; lymphatic vessels and lymph-canalicular spaces. The lymphatic vessels are composed of a thin endothelial wall; the lymph-canalicular spaces contain an albuminous fluid. The number of these lymph-vessels varies in different parts.⁴

The omentum is especially rich in groups of germinating cells; in many instances they are found on the surface of special thickenings of the normal membrane in connection with the vascular system. Sometimes they are found on peculiar papillary projections, particularly under pathological relations. The germinating endothelium sometimes contains cells which are in the act of division. Some are free and possess the power of amœboid movement, approaching the nature of the lymph-corpuscles. After becoming free, they find their way into the lymphatic vessels and then into the blood-vessels as colorless blood-corpuscles. In many mammals the amount of such germinating endothelium is very great, hence this membrane plays an important part in the generation of lymph and colorless blood-corpuscles.

The omentum also contains nodular or cord-like groups, of adenoid tissue covered on one or more surfaces with germinating endothelium. These masses have either well-defined outlines or are more or less diffuse. According to Klein, the lymphatic tissue in the omentum, being possessed of a special

system of blood-vessels, may at one time functionate as connective tissue, or at another time as fat-cell tissue.⁸

There is a large amount of adipose tissue which, towards the end of life, particularly in those people tending to obesity, accumulates considerable fat.

The surface of the omentum consists of a layer of endothelial plates (120 mm. in thickness) which are elastic; their interstitial cement substance being very soft. According to the state of contraction or expansion of the subjacent membrane or the direction to which it is being drawn, so will the shape of these plates be altered. There is a direct transition of connective tissue corpuscles into endothelial plates of the surface.⁸

Von Recklinghausen's claim that on the surface of the peritoneal cavity were stomata through which fluids freely passed to the lymphatic channels was so plausible, in consideration of the rapid absorption of fluids from the peritoneal cavity, that it went undisputed by histologists for a considerable time, until Muscatello and others disputed the presence of them.¹¹

MacCallum, in a strong paper, controverts the statement that openings exist, and negatives the idea that the peritoneal cavity is part of the lymphatic system, and even further disputes that the endothelium has any connection with the adjacent connective tissue cells, claiming an independent development.¹¹ Sabion claims, according to embryological investigations, distinctive origins for the endothelial cells and the subjacent lymphatics.

Functions.—The several functions of this membrane are determined by the different tissues which go to make up its substance, and as this organ is insuperably connected with other tissues contiguous, much that pertains to the functioning of the omentum is associated with similar conditions existing in nearby structures. The study of one implies a knowledge of the action of all.

From the time of the early anatomists the sole function attributed to the omentum was that of protector of the intestines against chill. Like many fictions in medical literature

this has long gone without protest. Of how little value it may be to the underlying intestines can be appreciated by any one who has taken the trouble to introduce a thermometer into a deep sinus and watched for the effect of an ice-bag on its reading.

I. Circulation.—The large blood-supply of the omentum makes it an important factor in maintaining an equilibrium of blood circulation. Physiologists teach the importance of the correlation between the intraperitoneal circulation and external conditions. Necessity demands, for relief of arterial tension, that some part of the circulation be capable of storing up blood. This the intra-abdominal vessels are alone capable of doing safely, being aided by the sensitiveness of the splanchnics to reflex irritation. Surgeons frequently note that during operations long prolonged the omentum changes color and becomes turgid with blood. Crile²³ holds that shock is due to reflex vasodilatation of the splanchnic area. The omentum with its loose tissues and numerous vessels must play an important part in this phenomenon. Under conditions which increase the pressure of blood in the portal system, the veins of the omentum become distended, and from them passes into the peritoneal cavity ascitic fluid. One observer, after amputation of the omentum for some incidental condition, noted the disappearance of the ascitic condition coexisting.

The omentum in its excursions through the abdomen may become adherent to some area of local inflammation and a collateral circulation sufficient to relieve the venous tension may be established.

II. Absorption.—Another important function is attained through the vascular system of the omentum in conjunction with the lymphatics; that is, the absorption of fluids and the taking up from the peritoneal cavity of suspended solids.

Wagner²² estimates a dog's peritoneum as capable of absorbing in one hour an amount of fluid equal to $\frac{3}{8}$ per cent. of the animal's body weight. Du Bar and Remy²² found the thoracic duct of a rabbit greatly distended in five minutes after a large intraperitoneal injection of albuminous fluid: that the

greater the percentage of albumin, the less rapid the absorption.

Absorption in the peritoneal cavity is partly by the lymph-stream and partly by the blood-stream. This absorption is not only of fluids, but of insolubles. Muscatello and Salzel claim that the solid particles are carried by the wandering cells to the lymph-stream, and the fluids largely by the blood.

Various factors influence the rapidity with which fluids are absorbed in the peritoneal cavity and the amount absorbed. Only under normal physiologic conditions can the maximum be obtained. The rapidity is regulated by two factors; the pressure exerted by the abdominal muscles and the movements of the diaphragm and intestines,—the diaphragm acting like a pressure and suction-pump. The movements of the intestines prevent the accumulation of fluid in any one part, so that it cannot follow the law of gravitation. They carry the fluids over the absorbing surfaces of the peritoneum and in this way greatly enhance the absorbing powers.

According to Nothnagel¹⁴ the absorption of the intra-peritoneal fluid is directly proportionate to the activity of intestinal peristalsis. Reduction in temperature of the peritoneal cavity reduces the absorptive power of the omentum, due to diminished peristalsis; dilatation of the blood-vessels and increased peristalsis tending to promote absorption.

Dudgeon and Sargent in their book on "The Bacteriology of Peritonitis"²² claim that whatever absorption cannot take place by the lymphatic channel must be done by means of the blood-stream. Provided that the endothelium is uninjured, bacteria and other foreign substances will be safely disposed of by the lymphatic route; but damage to the endothelium will at once allow absorption to take place by the vascular route, the extreme delicacy of the peritoneal membrane rendering it particularly susceptible to injury. The factors which retard or stop absorption have been investigated by Wagner and others, and are generally pathological. Venous engorgement may increase the peritoneal content. Reduction in the energy of intestinal peristalsis, together with diminished activity of the

diaphragm, and loss of tension of the peritoneal muscles, retard absorption.

According to Byron Robinson,¹⁸ the organ that the cells of the peritoneal cavity seek to become attached to is the omentum. Oppel¹⁴ has suggested that the path taken by the lymph-stream from the peritoneal cavity is chiefly by the great omentum. He gives as his reason that in many cases where the peritoneal lymph was free from bacteria a deposit of micro-organism was found on the great omentum.

Lodi¹⁴ states that the omentum plays an extremely important part in the absorption of both microorganisms and solid particles in the peritoneal cavity. Durham found that in an animal killed twenty minutes after an intraperitoneal injection of bacteria, the omentum contained bacteria while the peritoneal cavity was sterile on culture.

Muscatello observed color particles taken up by the phagocytes, which rapidly passed between or through the endothelial cells into the subjacent lymph-spaces.

The nerve-supply of the omentum according to Marcy,¹² plays an important rôle in the organism, maintaining a suitable equilibrium of flows in the abdominal cavity.

III. Cohesive and Adhesive Properties.—The *cohesive* tendency of the omentum is first evidenced in fetal life, when the mesogastrium unites with the mesocolon through either degeneration and absorption of the endothelium or more likely a retrograde metamorphosis of endothelia into connective tissue corpuscles. This same tendency can be demonstrated in advanced life when conditions are suitable, and is often noted when the omentum becomes incarcerated in a hernia.

The *adhesive* tendency of the omentum is a property peculiar to itself, as is the *cohesive*. When this membrane is irritated either through some regional inflammation or point of disturbed circulation, there is a transudation onto its surface, as well as into its superficial structures, of an exudate composed of white-blood cells and fibrin, which produce a stickiness. This leads the omentum to become attached to the offending portion and to encapsulate it. Continued irritation

will lead to a marked hyperphasia of the omentum. If the source of irritation does not contain germs too pathogenic or too numerous, or if the phagocytes and the opsonic condition be satisfactory, the ultimate result will be a restitution and gradual absorption of the hyperplased and exuded material, and a return to normal. Not all of the endothelia being disturbed, new endothelia are formed. In the subendothelial tissue is maintained an excess of the fibroid which will materially interfere with subsequent absorption from that point. If the disturbance to the peritoneum be more or less general, there is, as we find clinically, an acquired immunity to secondary infections.

Experiments by Schlitzler and Ewald show drying of the peritoneal surfaces to be an important element in the genesis of peritoneal adhesions; at the same time it retards the rate of subsequent absorption of fluids.

IV. Protective Rôle.—The wonderful discovery by Metschnikoff of the phagocytic action of the white-blood cells receives no better illustration of its value in the economy than in the peritoneal cavity, as this tissue is greatly prone to invasion.

The slight amount of tissue separating the contents of the intestinal tract from the sensitive peritoneum, and the numerous organs subject to lesion and traumatism, render this cavity particularly susceptible to microbic invasion. Had Nature not a method of protection sufficient for ordinary disturbances, life would not be long lasting. In phagocytosis we have this means of protection and in the omentum a ready organ for its elaboration and action.

The phagocytes, drawn from the periphery by chemotaxis, associated with those formed from the transformed endothelia, the adenoid and connective tissue of the omentum, are extruded into the peritoneal cavity.

The peritoneal cavity normally contains a small amount of clear fluid in which are suspended a number of cells. The character of these cells, according to Kanthak and Hardy, is 30 per cent. to 50 per cent. polymorphonuclear.

Opie ²⁴ states that polynuclear leucocytes with fine granulations accumulate in great quantity on the surface of the omentum and form compact clumps held together by a network of fibrin. The eosinophile leucocytes in large number penetrate into these masses of cells. He further claims that the eosinophile cells rarely if ever ingest bacteria.

Dudgeon and Sargent's experiments ²² seem to demonstrate that the granular eosinophile cells, which some have considered to be non-phagocytic and others slightly so, to be one of the most important, if not the most important, phagocyte in the early stages of peritoneal infection, while the finely granular polynuclear cells become a well-known important phagocyte in the later periods of peritonitis.

These same writers claim that on irritation of the peritoneal cavity, the staphylococcus albus appears on its surface, before there is any solution of continuity. It is generally found at a distance from the focus of irritation in association with numbers of phagocytes. Their conclusion is that from some unknown source this germ enters the peritoneal cavity ahead of all other more pathogenic germs, spreads rapidly over the entire peritoneum and omentum, and, by its minor irritation induces a rapid transudation of phagocytes, thus preparing the cavity to attack more virulent germs when they appear. Thus the omentum as a surgical factor in laparotomy is comprehended.

There is a general definite relation between the lymph-flow and cell-intrusion in the peritoneal spaces,—the obliteration of the lymph-channels from the peritoneal membrane by constriction of cicatricial tissue explaining why repeated lymphangitis becomes less and less dangerous.

Roger ¹⁹ considers the great omentum a flattened ganglia. To demonstrate the protective rôle of this membrane, he extirpated the omentum in rabbits and guinea-pigs. Later, after a period of a month or two, he injected into the abdominal cavity of the animals thus operated upon a few drops of the virulent culture of staphylococcus aureus. Death supervened in twenty-four hours, or at the latest within two or three days. Controls of the same weight to make the conditions identical

having been subjected to a simple laparotomy, received the same amount of culture, but survived. It should not be concluded, however, that the extirpation of the omentum entirely destroys the resistance of the peritoneum, for the animals thus operated upon survive if they receive a very small dose of a virulent culture, or if an attenuated microbe be employed. In repeating the inoculation, however, he noticed that the animals deprived of the omentum grew thin and cachectic, and finally succumbed, while the control animal manifested no disturbance whatever. This rôle of the omentum is especially marked in the young, because with age a fatty infiltration occurs which diminishes the activity. It is, however, in children that the peritoneum is frequently threatened by microbes which swarm in the gastro-intestinal canal and so often cause inflammation there.

The plastic exudate thrown out by the omentum at the point of lesion doubtless offers some purely mechanical protection against the spread of infection; it may also be that the secretion poured out from the omental vessels has some anti-toxic action. Further, the bacteria received into the lymphatics of the omentum are either rendered less virulent, or are else destroyed.

Byron Robinson says,¹⁸ "the great omentum is a valuable peritoneal veil. It may present many cicatrices showing old peritonitis. It prevents the invasion of infection, and circumscribes inflammation. It is a great peritoneal protector, and the surgeon's friend, burying the mischief he has wrought. It may show by old inflammation that it has checked peritonitis."

Experiments by Schlitzler and Ewald¹⁴ show a property of the omentum to be the rapid formation of plastic tissues on irritation, when an engorgement of the vessels takes place.

Robinson¹⁸ claims that in nearly all experiments when congestion and peritonitis arose the most intense congestion appeared in the omentum, and thus in peritonitis in both man and animal this intense congestion of the omentum is a characteristic feature. He claims that the omentum in peritonitis attempts to corral the phagocytes, or their adherent microbes, by taking them out of the peritoneal fluid and making them

adhere to its sticky surface. Careful examination will show that it harbors microbes while the peritoneal fluid is sterile on culture, but, if the microbes be very virulent, the stickiness of the surface will not suffice to ensnare or destroy them.

According to Warthin ²¹ after removal of the omentum, animals are more susceptible to intraperitoneal injections of microorganisms. In local traumatism, after operations and in local peritonitis, the omentum is commonly found attached to the affected area, shutting it off. The slightest irritation is sufficient to cause the omentum to attach itself.

V. Supplemental Function.—De Renzi ¹ found that if the circulation of the spleen be entirely cut off, the omentum gradually envelops and forms a capsule around it, inside of which it is in time completely absorbed. If the omentum be removed after the circulation of the spleen be cut off, the organ does not become encapsulated, and the animal speedily dies. When toxins are generated by gangrenous degeneration of the spleen or other organs, the omentum seems to possess the power of neutralizing these toxins.

Pirrone ¹⁵ confirms the findings of De Renzi, and claims that the action is done by phagocytes originating in the omentum and devouring the detritus of the spleen. He compares the endothelium of the omentum to that of the blood-vessels in respect to thrombus. He claims that after extirpation of the spleen, there is nothing to indicate that the omentum undergoes modified transformation to compensate for the missing organ.

Pirrone proved the phagocytic action of the omentum. He experimented with injections of sodium taurocholate in splenectomized animals and induced immunization from this drug. When he compared the results with those obtained with nonsplenectomized animals, he found that the omentum had evidently tried to compensate for the absent spleen. Compensatory plastic processes in the lymphatic follicles were unmistakably apparent. The findings suggest functional relations between the spleen and the omentum beyond what physiologists have hitherto imagined.

Warthin ²¹ finds hæmolymp-h-glands of the splenic type

existing in the omentum, and it is possible that they may take on vicarious action, become enlarged, and functionate for the destroyed spleen.

Résumé.—1. The numerous blood-vessels and lax tissues of the omentum allow of storage of blood when the general arterial tension is high.

2. By venous anastomosis through adhesions, local congestion may be relieved.

3. Through its large surface freely exposed to surrounding parts in motion, it becomes a rapid absorber of fluids by the blood-stream.

4. By the lymph-stream it is a free carrier of white-blood corpuscles, encapsulating solid particles.

5. Through its cohesive tendency, apertures in the abdomen into which the omentum has been forced by intra-abdominal pressure become more or less completely closed.

6. Through its readiness to lymph formation and local proliferation, it becomes attached to infected parts, which are walled off, subsequently to be absorbed by phagocytic action; the peritoneal cavity thereby protected.

7. The majority of the phagocytes extruded into the peritoneum for its protection come through the omentum, largely from the general circulation, but in part from the tissues therein existing; subsequently to be attached to the surface of this tissue, taken into the lymph-stream, and subjected to the cytolytic influences existing there.

8. Lack of development of the omentum, or loss through operation, renders one less resistant to peritoneal invasion.

9. Hæmolympth-glands of the splenic type existing in its base supplement the spleen if the latter be removed or its functions interfered with.

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A FURTHER REPORT ON A CASE OF CIRRHOSIS OF THE STOMACH.

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ON January 4, 1903, an exploratory laparotomy was done on Mr. H. C. C., of Telluride, Colo. The stomach was found to be very small, its walls markedly thickened and indurated, but the organ was not deformed. Its cut surface appeared fibrous. The mucosa, as far as could be determined, was smooth and atrophic. A gastro-enterostomy was done. The case was thought to be one of benign diffuse cirrhosis of the stomach.

At this time, June 26, 1906, three and one-half years after the performance of the operation, the patient remains perfectly well. He works on his farm constantly, and eats ordinary food without discomfort. His weight and strength are fully up to the standard for a man of his age.

In reporting this case,* together with the reports of ten other cases of cirrhosis ventriculi observed post mortem by Hadden,¹ Turner,² Hanot and Gambault,³ Jacobi,⁴ Bernabei,⁵ Osler,⁶ Leith,⁷ and Allbutt,⁸ it was held that a benign diffuse cirrhosis of the stomach, though a rare condition, does occur; that it is not associated with cancer; and that cirrhosis of the stomach may be sufficiently severe to terminate the patient's life without cancerous involvement being present.

It has been a much discussed question whether a non-malignant cirrhosis of the stomach exists. The clinical and post mortem evidence indicates clearly that while it may be at times difficult, or even impossible, to distinguish between a diffuse carcinoma of the stomach and a cirrhosis ventriculi, still, in rare instances, a benign cirrhosis of the stomach does

* ANNALS OF SURGERY, Nov., 1905.

occur. Andral,⁹ Cruveilhier,¹⁰ Brinton,¹¹ Habershon,¹² Wilks,¹³ and most of the earlier writers, have clearly drawn the distinction. The evidences on which their opinions were based, it must be admitted, were imperfect; but the conclusions of so many close clinical observers are not without their weight in this matter. Most of the recent writers give the condition recognition, but their statements are brief and in no way convincing. Einhorn¹⁴ makes the positive statement that a benign cirrhosis of the stomach does occur. Osler¹⁵ recognizes the condition and reports one characteristic case. Hemmeter¹⁶ states that the pylorus may be the seat of a hypertrophic stenosis, and that in rare instances the entire stomach may be involved in the hypertrophic process. Leith⁷ recognizes the condition and discusses it at some length.

On the other hand, there are many who doubt the occurrence of a benign diffuse cirrhosis of the stomach. Most German writers believe that all of these cases are carcinomatous. Bret and Paviot¹⁷ share the same opinion with the Germans. They state that their conclusions are based on the condition of the perigastric glands in their cases. They admit that no evidence of carcinoma was found in the stomach-walls themselves, but in the same case the lymphatic glands showed cancerous involvement. Their report is incomplete; and, although one is led to believe that they have made several examinations, only one case is reported. G. B. Hunt is another who argues against the occurrence of a benign diffuse cirrhosis of the stomach. He holds that all cases of diffuse thickening and contraction of the organ are malignant. He offers no proof in support of his opinion except that he has observed one case of diffuse carcinoma of the stomach.

The fact that the patient I have treated has remained well three and one-half years after the operation was performed, strongly suggests that the process involving this markedly contracted, thickened and indurated stomach, was not carcinomatous.

The cause of the symptoms and the mechanism of relief in this case would seem to be as follows: The long-standing,

and progressive, gastric symptoms were dependent upon the changes in the stomach-walls and the gradual narrowing of the pyloric orifice. The pain and excessive vomiting, after the taking of solids or even liquids, that occurred so constantly during the few months preceding the operation, were due to the condition of the pylorus which was almost, if not quite, closed. Starvation would account for the patient's serious general condition.

The gastro-enterostomy permitted food to pass from the stomach to the intestine, affording a means of nourishing the patient. I cannot think that this stomach, on account of the condition of its walls and mucosa, aids materially, either chemically or mechanically, in nourishing the patient.

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RUPTURE OF THE INTESTINE.*

REPORT OF TWO CASES.

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FROM a recent contribution on this subject by Campbell,¹ of Montreal, it appears that up to 1890 the number of cases of intestinal rupture which had been treated surgically was very small as far as literature could show, and of such as have thus been treated few if any reported recoveries are to be found. Since that time, however, a fairly good number of operations for this condition has been reported and of this number a few recovered. For the period from 1894 to 1904 Campbell's search shows twelve recoveries reported in English and American literature, eleven in French and nine in German. As to the percentage of recoveries following operation, the figures given vary with different reporters, from nine per cent. by Campbell to forty-two by Gage.

Speaking generally this condition is not frequent. Out of about 1,300 surgical admissions of the Montreal General Hospital, covering a period of ten years, and representing a large emergency service, there were only eight cases of intestinal rupture. My own experience, the basis of this report, would lead me to believe that this form of injury is rather frequent in localities where there are extensive public works of a character to expose the men to accidents in which traumatism by squeezing frequently occurs. The lumbering and coal-mining industries of this state probably produce a large number of these cases. In a little less than five months two cases of this kind came under my care.

* Read before the West Virginia State Medical Association, June 22, 1906.

¹ ANNALS OF SURGERY, Nov., 1905.

CASE I.—H. S., aged twenty-five, a native of West Virginia, brakeman on a log train. November 16, at 5 o'clock P.M., was engaged in unloading a carload of logs which stood at the upper end of the log-dock and directing them into the pond at the lower end of it, when one of the logs became unmanageable and threatened to land upon him. To escape it he jumped from the log-dock, aiming to land on a pile of logs floating in the pond below. This he missed and instead landed into the pond right against this pile of logs. At the same instant the log from which he was trying to escape reached him with great force, striking him in the back and driving him against the logs in front of him. This log came down from a height of about twenty feet. He managed to disengage himself from between the logs and walked to the edge of the pond, a distance of about six feet, where he was pulled out by his fellow-workmen. On attempting then to walk he fell and complained of severe pain in the abdomen. He was placed in the car of a train which happened to pass by just then and transported to the Davis Memorial Hospital, about forty miles distant. The physician who accompanied him gave him one-half grain of morphine hypodermically while in transportation.

He reached the hospital at about 7.30 P.M. An examination showed the entire absence of any mark of external injury. The abdomen was not distended and the area of liver dulness was normal. There was some dulness in the hypogastric region. The abdominal wall was extremely rigid and he complained bitterly of intense pain all over the abdomen. The urine was free from blood. The passage of a rectal tube gave no result. There was no vomiting. Facial expression was that of great suffering. Temperature about normal; pulse 104 and of good quality. He was placed on the operating-table at 10 P.M. A median incision through the umbilical region showed the following:

The omentum was torn longitudinally in two for its entire lower half. The small intestine, probably about its middle, was torn completely in two. The mesentery for about six inches was torn away from the lowermost end of the ileum. The inner layer of the mesocæcum was torn off the cæcum, and the meso-appendix was torn off the appendix except at its very tip. There was a good deal of blood in the abdomen and pelvis, and active bleeding from the mesentery was still going on. The

amount of fecal escape was small, being limited to a slight soiling of the immediate vicinity of the torn knuckle of intestine.

The ends of the ruptured gut were approximated by a Murphy button and reinforced by a Lembert suture of silk. The omentum was repaired and the mesenteric folds were sutured back onto a narrow frill of the same which remained attached to the ileum and cæcum. The appendix and its mesentery were removed. All bleeding was stopped and the abdomen freely flushed with salt solution. A large glass drain was placed in the pelvis and the greater part of the wound was closed. The shock during and for some hours following the operation was great, necessitating intravenous infusions and the other usual measures. When returned to his bed at about 12.30 his pulse rate was 166 and respirations 54.

November 17, at 6 A.M., within seven hours after the completion of the operation, he passed some flatus spontaneously. At 9 A.M., temperature 99.6, pulse 126 and respiration 28.

November 19, at 9 A.M., temperature 100, pulse 100 and respiration 24. At 12, that is thirty-six hours after the operation, he had a small bowel movement of fecal matter following an enema.

November 20, temperature 98.6, pulse 80 and respiration 24.

November 22. As there was nothing but clear serum found in the drain it was removed on that day and the wound entirely closed.

From this time on his complete recovery was uninterrupted and the outside wound closed by first intention. After a sharp diarrhœa of twelve hours duration he passed out the button on December 26 last, that is on the forty-first day. He has remained well and has been at work since.

CASE II.—W. M. G., aged twenty-nine, a native of West Virginia, teamster. April 12th last, at 2 P.M., while following on the lower side of a hill alongside of several logs dragged by his team, one of the logs rolled down on him, striking him over the left gluteal region and driving him against a stump, the latter impinging against his left iliac region. He was admitted to the Davis Memorial Hospital at about 7.30 P.M. I have not been able to learn whether morphine was given him before his admission, but in all probability this was the case. A very superficial skin abrasion was found over his left hip. There was no

marked distention of the abdomen. The area of liver dulness was reduced to about one-half. Urine free from blood. The passage of a rectal tube gave no escape to feces or flatus, but on removing it the end was found soiled with some mucus and blood. The abdominal wall was rigid but not extremely so. Pain was present but not to an extreme degree; no vomiting. Temperature 100.4, pulse 80 and respiration 20. At 12 midnight the temperature was 99.4, pulse 76 and respiration 32. By that time his pain increased considerably and the rigidity of the abdominal wall became extreme.

He was placed on the operating-table at midnight. On opening the abdomen considerable gas escaped and the peritoneal cavity was found full of intestinal contents. A tear about large enough to admit the little finger was found in the ileum, probably about six feet from the cæcum. There was no other structural damage and no blood. A general and advanced peritonitis was present. The tear was closed with a purse-string suture and the abdominal cavity freely flushed out with salt solution. The removal of a large number of tomato-seeds was particularly troublesome, necessitating some evisceration. Drainage was provided as in the preceding case. At 1.30 of the next day he passed flatus, but died at 6 P.M. from peritonitis.

There are several points which seem to me of particular interest in these cases. It is accepted as generally true that when a rupture of intestine takes place it does so in such portions of it where its mobility is restricted on account of a short mesentery. In Case I the rupture took place at a point where the intestine is usually quite mobile and in this case the mesentery at this point was abnormally long, affording great ease in isolating it from the rest of the gut while making the anastomosis. On the other hand as far as the tearing of the mesentery is concerned it followed the rule. The tearing of the omentum is unusual. Although much more extensively injured than Case II, recovery followed. There were two factors in this case which are to be credited with much for the result. One, the fact that circumstances favored an early operation, and the other the fact that the injury occurred four

or five hours after a meal, that is, at a time when the alimentary tube is the least filled. The suturing back of the mesentery to the narrow frill which was left attached to the gut gave me some misgivings at the time, fearing that the circulation would not be restored sufficiently to keep the corresponding portions of gut from dying, and more especially in reference to the ileum. By the time this part of the operation was reached the patient's condition was such as to make a resection out of the question, and I took chances on a procedure which some may possibly be disposed to consider as objectionable. The amount of damage in Case II was very much less and yet it resulted in an early death. The occurrence of the injury close to a meal and the delay in bringing him to the hospital were no doubt the main factors in producing the fatal issue in this case.

Were I asked what particular symptoms are to guide one in the diagnosis of such conditions, I would emphasize rigidity and pain. Given a case in which an injury to the abdomen occurred which is *liable* to produce rupture of the intestine, and the abdominal wall is found rigid and the patient is suffering from pain in that region, one should not hesitate to operate even in the absence of all other symptoms. In these two cases the absence of any result following the passage of the rectal tube lent some strength to the diagnosis at the time. However, in the case of a large typhoid perforation I have seen a large stool to follow a simple enema.

REPORT OF A CASE OF INTUSSUSCEPTION SUBJECTED TO OPERATION.

COLON OPENED AND PART OF INTUSSUSCEPTUM EXCISED; ENTEROSTOMY FOR
FECAL DRAINAGE; LATER EXCISION OF SEGMENT OF SMALL INTESTINE
AND ENTERORRHAPHY FOR SUPPRESSION OF FECAL FISTULA; ULTIMATE
COMPLETE RECOVERY.

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AND

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THE unfavorable general conditions of this case, together with the extent of surgery involved, make it worthy of record.

G. S., male, eight years of age, was in rather poor health through the winter of 1905-6, but made no special complaint up to April 1, 1906. At this time the glands on the left side of neck below the ear became swollen; there was headache and fever up to 103° F. At this time the mother noticed that urine was scanty and "like black coffee." After about two weeks the swollen glands subsided, and about this time he began to complain of pain in the abdomen, cramp-like in character, and recurring about every fifteen minutes. He vomited in the beginning of the attack of pain, but this soon ceased and did not recur. Bowels were inclined to be constipated during the sickness after April 1; after cramps began, movements could be had in response to enemata but were always small and contained mucus and occasionally small amounts of blood.

After five days of cramps the child was brought to hospital in Louisville where he was first seen by reporters. At this time his general condition seemed fairly good. He looked well, except for the evident suffering on the recurrence of the cramp-like pain. A tumor about the size of an adult kidney could be plainly felt beneath the border of the ribs in the nipple line on the left side. A peculiarity of this tumor was that it would change its position, sometimes being found lower down in the abdomen

below the line of the umbilicus, sometimes higher up just below the costal border, but always remaining on the left side. Having the hand placed on the tumor at the time the pain would come on, the hardening of the intestine beneath the hand could be distinctly felt, very much like the hardening of the uterus with a labor pain. Temperature at this time was 102° F.

Examination of the urine showed evidence of an acute nephritis—quantities of red blood-cells and epithelial casts. In view of this condition, and the fact that the condition had already existed five days, and the further fact that the child's condition was not of a nature to demand instant interference, he was kept under observation in the hospital for nine days, during which time his general condition steadily improved and the signs of nephritis gradually diminished. The tumor and the cramp-like pains were still present, but the latter came at longer intervals and were less severe. The bowels continued to respond to the enema, the stools appearing about normal. At the end of nine days (fourteen days from beginning of abdominal symptoms) the patient was permitted to leave the hospital and go to the home of a relative in the city. Temperature was normal. Here he remained thirteen days, when suddenly the abdominal pain became excessive, vomiting recurred and persisted. Before he could reach the hospital he had a number of convulsions and appeared to be almost *in extremis*. Operation was at once undertaken under ether anæsthesia. Vomitus ejected on operating-table was fecal in odor.

An incision was made in the left linea semilunaris, over the site of the tumor, which was immediately apparent within the lumen of the descending colon. The colon was incised for about three inches, exposing the intussusceptum, which was drawn out and excised, the tumor mass being about six inches in length. The bleeding mesenteric vessels were caught in sutures and tied, and a running stitch united the cut colon to the ileum. The stump was allowed to drop back into the lumen of the colon and the longitudinal incision into the descending colon was closed by continuous suture.

As it was certain that the excision was at a point several inches removed from where the intussusceptum entered the intussusciens, it was deemed advisable to draw a presenting coil

of the distended small intestine into the lower angle of the wound, fix it there, and open it as the concluding step of the operation. We are inclined to believe that the immediate relief so afforded was the determining factor in the child's recovery, and that without it he would have speedily succumbed.

It has frequently been observed that the swelling at a point of constriction is encouraged by the hammering from above of the fecal mass, and that such swelling speedily subsides if relieved of the fecal burden.

No effort was made to reach the point where the intussusceptum entered the intussusciens, where amputation would preferably have been made. The extremity of the child's condition was such that only the more accessible portion of the tumor was removed, several inches of the invagination certainly remaining behind. It would have been better had the incision been made in the median line.

The child reacted surprisingly well from the operation. The discharge from the fistula was profuse. At the end of five days, there being evidences of infection of the wound margins, the stitches were removed, whereupon the wound edges separated widely, both surfaces showing a purulent infiltration. It was necessary to pack and strap the wound to prevent the prolapse of the intestines. Fortunately the intestine was already adherent to the peritoneum at the margin of the wound. The wound gradually cleaned out and healed up satisfactorily, only the fistulous opening in the small intestine remaining. As the subsequent events proved, the fistula was established high up in the course of the small intestine. The bowel drainage excoriated the skin and kept it raw, to the great suffering of the child.

Within a few minutes after the ingestion of food, a thin, acrid discharge would begin from the fistula, and oftentimes particles of food would be discharged within ten minutes of the time they were swallowed, and practically unchanged.

The bowels moved on the day after the operation, the stool consisting chiefly of dark blood, evidently from the seat of amputation. Thereafter bowel movements occurred, gradually establishing regularity and being normal in appearance.

June 23.—The boy's general condition is fair; he has taken on some weight since the operation, but has apparently reached

a standstill on account of the continual losses through the fistula. The bowels are moving every day, dark, soft, natural in character. Following the operation for two or three weeks a cramp-like pain was complained of every now and then beneath the right costal margin, evidently at the point of resection where some constriction remained. For two weeks there has been no pain except the burning occasioned by the fluid escaping from the fistula. Urine is normal—no albumen, no blood, no casts. Appetite is good, but child fears to take food because it sets up immediately a profuse discharge, with excessive discomfort from the accompanying burning.

Operation is to-day undertaken to close the fistula. On attempting to separate the small intestines from the abdominal wall, the adhesions are found very dense and the intestine is torn in several places, rendering it so ragged that a resection of about four inches has to be made, with end-to-end anastomosis by suture.

After this operation convalescence was uneventful. The boy returned to his home and is reported in excellent condition, appetite, digestion and defecation being normal.

It would seem possible that a danger for the future still exists, that being the possibility of contraction at the point of excision of the intussusceptum, with consequent interference with the onflow of the fecal mass. This danger is minimized by the fact that at the point of this possible constriction the fecal matter is always fluid in character and hence little liable to stagnation because of the reduced size of the intestinal calibre.

Examination of the specimen shows the intussusception to have been of the most usual variety, the ileocæcal, the apex of the tumor being formed by the ileocæcal valve. The several peritoneal coats of the bowel which lay in contact are fused completely.

In about three weeks after the beginning of the glandular swelling in the neck, distinct desquamation occurred. It seems practically certain that the desquamation, the nephritis, and the swollen neck glands, were all symptoms of scarlatina.

ANGULATION AT THE SIGMOID.

BY G. PAUL LAROQUE, M.D.,

OF RICHMOND, VA.

THIS condition, to which attention was recently called by Dr. H. Beekman Delatour, in the *ANNALS OF SURGERY* (Nov. 1905), while perhaps more common than is generally supposed is yet sufficiently rare to justify a more or less detailed report of every case observed. The following case is worthy of being placed on record since the condition was recognized and remedied at operation, since which the patient has been absolutely free from symptoms. The woman was a patient of Dr. Stuart McGuire at St. Luke's Hospital, through whose courtesy I was enabled to study the case and to whom I am indebted for the privilege of this report.

Miss Y. About four years ago, at the time of her graduation from school, she had a mild attack of dysentery confining her to bed a few days. She has always led an active life and was always remarkably healthy. She has taught school about four or five years.

In the latter part of the fall of 1902 while visiting away from home, was seized one evening while dancing by an attack of severe colicky abdominal pain, nausea and vomiting, so that she had to give up dancing. This pain was attributed at the time to dietetic error and the next day she was comfortable except for general abdominal soreness. Within the course of a few days she was tolerably well, however, except for marked constipation. During the winter there were occasional recurrences of such paroxysms and constipation became so marked as to necessitate purges.

From March 17, 1903, she suffered for about a month with paroxysms of intermittent violent pain of the type of intestinal colic, attended by nausea, obstinate vomiting, marked constipation, great abdominal distention, and with it all she was completely prostrated. She was operated upon at her home for

intestinal obstruction. Upon opening the abdomen no obstruction was found, but the appendix, slightly adherent, was removed. During convalescence from the operation, the distention and other symptoms persisted, and constipation was absolute for seven days. Upon getting up she noticed persistent abdominal distention. Her physician treated her almost continuously, especially for constipation, and was forced to administer enormous doses of strong purgatives. Licorice powder would generally be fairly effectual.

The distention persisted, constipation has become more marked, and she has frequently suffered violent acute paroxysms of pain, nausea, vomiting and prostration.

In January, 1904, not having improved, she was operated upon again and her uterus, slightly retro-displaced, was suspended, with no effect on the symptoms.

She has continued to suffer recurrent paroxysms of violent pain, vomiting and prostration; abdominal distention has persisted and she has not had a proper evacuation of the bowels in "three years." She has had to continue taking purges and enemata and came to St. Luke's Hospital for treatment.

Collateral facts elicited in the history were of diagnostic value. She has frequently noticed the passage of a little blood by the bowels and on two or three occasions this amounted to a "couple of tablespoonfuls" of dark and clotted blood; she has noticed none of this during the past six months. The evacuations have been made up largely of mucus, at times in very marked quantities and in large flakes, especially in the second and third enemata. Purges produce violent increase of pain; enemata and the passage of rectal tubes are agonizing. There is never the slightest evacuation nor desire for such spontaneously; frequently two or three enemata are required and these are only partially successful. There has never been a formed movement.

On one or two occasions she has had pain of similar type but having the location and radiation of right sided renal colic. Her physician has found leucocytes, red cells and small quantities of albumen in her urine.

For the past year she has had dysmenorrhea, and purgation occasionally precipitates menstruation.

She is otherwise well and hopeful. She has had no fever nor

chill nor been unconscious, though during the pain she is violently prostrated. There have been no crying paroxysms, convulsions nor stupor.

Upon admission to St. Luke's Hospital she was suffering a violent attack with great distention, rapid pulse, and other signs of a moderate degree of shock. After several days and repeated efforts, a partial evacuation from the lower bowel was secured. Sometime later during the course of vaginal examination the rectum was found impacted with fæces. Examination of the pelvic organs was negative. During the first two or three days of June, 1906, she suffered again a violent paroxysm similar in character to the above; a week later, after sigmoidoscopic examination, another attack, and the following day after cathartic pills a most violent one. The abdomen was markedly distended all over and there was a transverse constriction at the waist line, *i.e.*, just above the umbilicus. Respiratory mobility is unimpaired. Measurements are as follows: at the xiphoid cartilage, 30 inches; half-way between xiphoid and umbilicus, $28\frac{3}{4}$ inches; at the umbilicus $29\frac{1}{4}$ inches; half-way between the umbilicus and the pubis $32\frac{1}{2}$ inches. There is some lordosis in the lumbar region, but this is due to prominence of the buttocks rather than to any spinal curvature. There is slight general abdominal tenderness, somewhat more marked on the right side. Nearly the whole of the colon is palpable, but none of the other abdominal organs can be felt. The abdominal rigidity is that only of distension. Percussion notes a general tympany and diminished area of liver dulness; the splenic area cannot be outlined. There is no area of circumscribed dulness. Auscultation elicits slightly exaggerated sounds incident to peristalsis. Auscultatory percussion is entirely negative.

At this point a provisional diagnosis of incomplete intestinal obstruction was based on the following: (1) A history of recurrent attacks of violent abdominal pain attended with nausea, vomiting and moderate shock (prostration) and a number of times followed by the passage of blood; (2) obstinate, almost absolute, constipation; (3) intestinal distention; (4) hypertrophy of the colon.

Rectal Examination: Externally no sign of disease is seen. Marked pulsation of the hemorrhoidal arteries is noted and

the rectum is empty. The passage of a proctoscope is attended by agonizing pain in spite of the previous administration through the rectal tube of a pint of olive oil. There is an area about eight inches from the external sphincter in which there is greatly exaggerated tenderness and distinct resistance, though this is finally overcome and the instrument passed sixteen inches into the bowel. Inspection notes an apparently sessile growth projecting into the lumen of the canal just above the junction of the sigmoid and the rectum. The mucous membrane of the rectum is moderately red but shows no signs of localized disease and is empty. The sigmoid contains a small quantity of fecal matter and its mucous membrane is thrown into folds and hypertrophied. There are no ulcers and only moderate inflammation. There are no signs of hemorrhoids, fistula, nor fissure. The examination was agonizing to her though she bore it bravely. The colic and local pain persisted until 4 o'clock in the afternoon at which time it was relieved by $\frac{1}{12}$ gr. morphine administered hypodermically.

Cœliotomy was performed June 11, 1906, by Dr. McGuire. The large intestine was distended with gas and fæces; the rectum was empty. A careful search was made of the entire intestinal canal. The sigmoid was found attached by a very short mesosigmoid, causing rather sharp angulation. The colon above this point was filled with fecal matter and the rectum empty. After dividing the short mesosigmoid the fæces were easily manipulated into the rectum. Continuing the examination there was noted some adhesion of the omentum about the stomach. From the sense of touch it was impossible to find any lesion of the mucous membrane.

What had seemed to be a growth arising from the mucous membrane, as seen through the sigmoidoscope, proved to be an invaginated portion of the mucous membrane of the sigmoid flexure through the portion constricted by its short mesenteric attachment, and causing angulation of this part of the gut.

The uterus was held anteriorly by an artificial ligament about an inch long, resulting from a previous ventro-suspension. The old scar was dissected out and the abdominal wall united in layers.

Convalescence was uninterrupted and on the third day following operation a painless bowel evacuation was secured by the

administration of two drams of extract of cascara followed by a simple enema. At the present time she is entirely free from symptoms.

I believe that the condition of angulation should be recognized in the future since the subject has been so admirably described by Dr. Delatour.

Since Dr. Emil Reis called attention in the *ANNALS OF SURGERY* (Oct. 1904) to mesosigmoiditis in its relation to recurrent volvulus of the sigmoid flexure, it would be interesting to know how much causative effect can be attributed in this case of angulation, to the previous attack of dysentery. Since this affection, when it attacks the sigmoid flexure, may be, and frequently is attended by inflammation of the mesosigmoid, it is logical to believe that the contraction of such inflammatory tissue after recovery might easily produce shortening of the mesosigmoid. Could this have been the case in the patient whose record is here reported?

HERNIA INTO THE ILEOCOLIC FOSSA.

BY EDWARD REGINALD SECORD, M.D., C.M.,

OF BRANTFORD, ONTARIO.

THE ileocolic fossa has been variously designated as the anterior vascular fossa, the fossa of Luschka, the superior ileocæcal fossa, the recessus ileocæcalis anterior, and the anterior ileocæcal, or preileal fossa.

It is described by Moynihan¹ as a narrow fossa or chink, situated between the anterior vascular, or ileocolic fold in front; and the enteric mesentery, ileum, and a small portion of the upper and inner part of the cæcum, behind.

In the Arris and Gale lectures for 1899 Moynihan states that so far as he is aware there are no cases on record which can be considered as hernia protrusions into the ileocolic fossa; that it is only of anatomic interest, and has no pathology. In a fairly comprehensive survey of the literature published since that date I have been unable to discover any report of such occurrence, and I have therefore concluded that the following case was of such rarity and interest as well might merit its being briefly described.

It is that of a frank, distinct, and undoubted hernia of the cæcum, appendix, and about four inches each of the terminal ileum and ascending colon, into the ileocolic fossa; with strangulation and obstruction caused by the anterior vascular fold; laparotomy being performed, the obstruction being relieved, and recovery finally ensuing.

J. T., aged forty, white, laborer, previously healthy, was seen by me in consultation with Dr. Bier, of Brantford, on October 7, 1905. He then presented the following conditions: Recurring

¹ On Retro-Peritoneal Hernia, by B. G. A. Moynihan, M.S. (Lond.), F.R.C.S. (Eng.).

abdominal pain, obstinate constipation, retching, and some vomiting.

History.—The patient had been well and worked at his occupation until two days before, when the abdominal pain began, of a spasmodic cramp nature, recurring in character, and rather increasing in severity. The first night the bowels had not moved, castor oil had been given, but ineffectually, and finally an enema had brought away some hardened fecal masses, but no gas, and

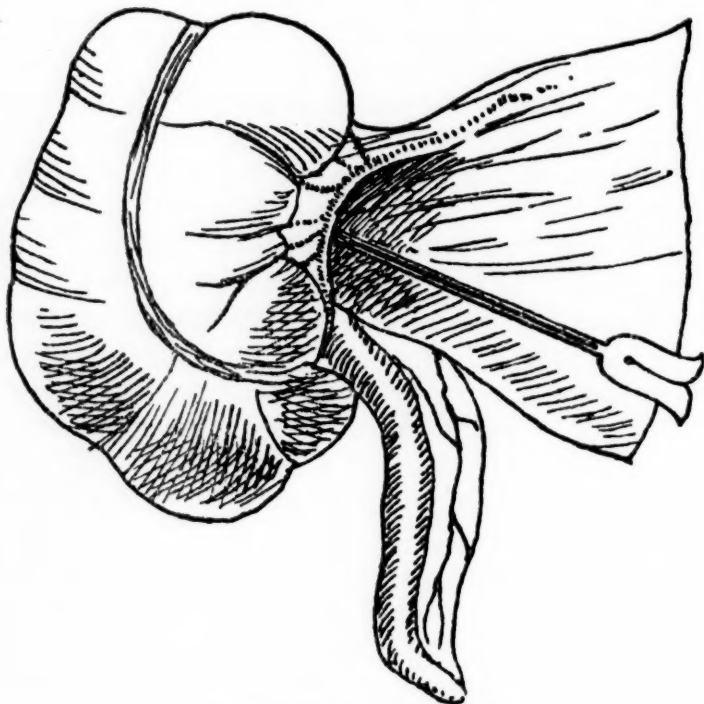


FIG. 1.—Hernia into the ileocolic fossa.

had produced no alleviation of the pain. The second day he had vomited once, and had shown a tendency to increasing pulse rate. He was removed to the John H. Stratford Hospital, where I saw him.

He was a healthy-looking man of about forty, with an expression somewhat worried or drawn, but not typically hippocratic. Temperature $98\frac{3}{5}$. Pulse 100. Respiration 16.

His abdomen was slightly distended, especially on the right

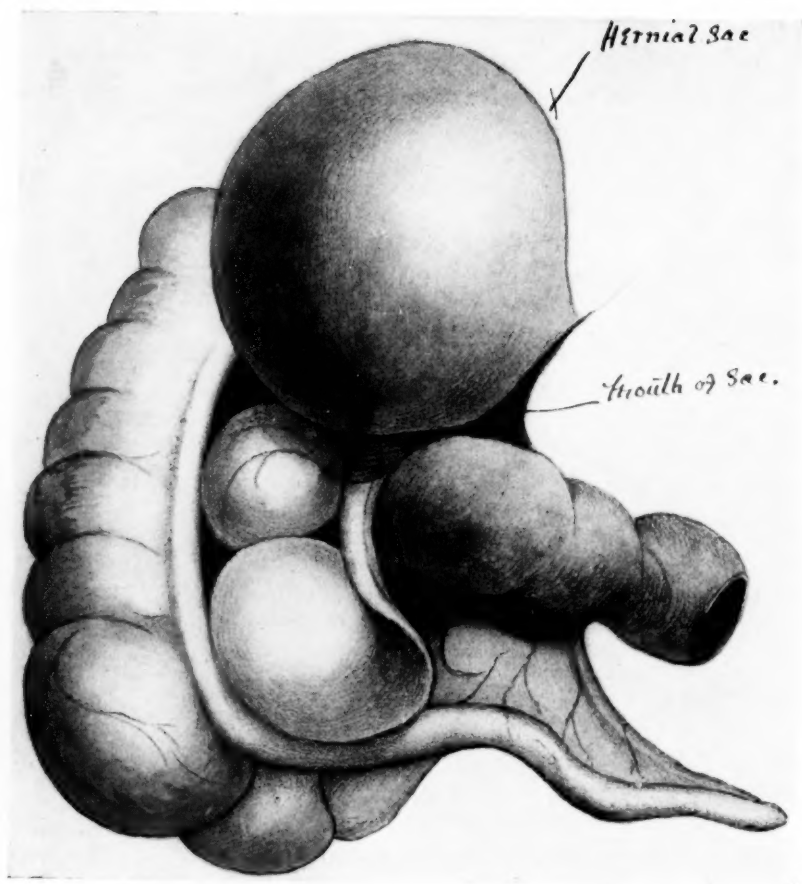


FIG. 2.—Hernia into the ileocolic fossa.

side. There was no board-like rigidity, but a feeling of resistance over the right rectus muscle, and general tenderness over the whole right lower quadrant. On observing the abdomen for a few moments, it was distinctly noticed that with the onset of the pain an elevation or tumor became evident below and to the right of the umbilicus. It was, roughly speaking, rounded in outline, and about the size of an orange. This elevation was evident not only to inspection, but also to palpation. It was doughy, tender, tympanitic, and localized in the one position, that is, it did not travel along the bowel as a peristaltic wave. Usually a distinct gurgling was heard during the acme of the pain.

Operation.—The abdomen was opened by an oblique incision over the appendix region. What appeared to be the distended and markedly-congested cæcum and colon appeared in the wound, which former, however, on closer examination showed themselves to be covered by an additional layer of peritoneum; the parietal peritoneum had of course already been well opened. This additional layer of peritoneum was quite thin, fairly transparent, and easily movable over the subjacent bowel. External to this mass was another loop of what appeared to be colon. Following this latter loop upward it appeared to be continuous with the ascending colon, but on following it downward to the appendix region no caput coli nor appendix could be discovered; and on searching more inwardly a taut band was found running in an oblique direction downward and outward from the root of the mesentery, roughly, in a direction toward the anterior superior spine (Fig. 2). The colon bulging out from beneath this band was without the additional layer of peritoneum noticed above and on slight traction being made on this loop of colon it slipped out from beneath the band, followed by the cæcum with the appendix, and the terminal four inches of the ileum. These portions of the bowel were all distended and markedly congested, and in one area on the outer surface of the cæcum the bowel-wall was ecchymotic, and in the centre of this a small whitish slough was situated. This slough was looked for and found, since on withdrawing the bowel from under the above mentioned band, a fecal odor had immediately become noticeable.

The pouch of peritoneum left by the withdrawal of its contained intestines was shaped much like a rubber tobacco-pouch,

with its mouth about an inch and a-half across, pointing in a downward and inward direction. When filled the size of the pouch would be somewhat greater than that of the folded fist.

The mouth of the pouch was closed by a single row of catgut, attaching the taut anterior fold to the anterior layer of the mesentery of the lower end of the ileum.

The patient's condition not justifying any attempts at resection, I sewed the parietal peritoneum to the cæcum round the gangrenous area, and opened the bowel at the situation of the slough.

The fecal fistula thus established, discharged practically the whole fecal excreta for a time, but gradually closed down by cicatrization, until at the end of November a small fistula remained, discharging only when the bowel contents were unusually fluid. At this stage nature's efforts at a cure seemed to become exhausted. The fistula remained practically stationary for the next month.

At the first of the year I therefore opened up the fistulous tract down to the cæcum, closed the opening in the latter by inverting the edges and placing two rows of catgut sutures, bringing together the opposed peritoneal surfaces. The different layers of muscles were dissected out from the scar tissue, and carefully approximated, and the skin incision closed by silk-worm gut. Aside from some slight skin infection, the healing process was perfect, and the patient was discharged three weeks afterwards.

He has remained entirely well from then to the present date.

TRANS-URETERO-URETERAL ANASTOMOSIS.

I—INTRAPERITONEAL. II—RETROPERITONEAL. (a) ANTERIOR TO AORTA AND VENA CAVA; (b) POSTERIOR TO AORTA AND VENA CAVA.

BY NORVELLE WALLACE SHARPE, M.D.,

OF SAINT LOUIS, MO.

I. History of Ureteral Anastomosis.—One of the earliest operations, if not actually the pioneer case of ureteral anastomosis, was made by Simon, of St. Thomas' Hospital, London, in 1851, in an effort to extraperitoneally anastomose the ureters into the rectum. Nussbaum followed the method of Simon in 1876; also Smith in 1879. Most of the early attempts were made for the relief of vesical extrophy. Gluck and Zeller were among the early experimenters on animals. In 1886 Schopf,^{23 24} a German, and Poggi,³⁹ an Italian, within a few days of each other performed an end-to-end anastomosis, though by different methods. Much experimentation on animals now developed in the years following this notable advance. Budinger in 1896 endeavored, on animals, to duplicate previous work, but with fatal results. Tizzoni and Poggi removed the entire bladder; a new receptacle was formed from an intestinal loop, and the ureters were implanted therein. In 1892 the technique of Van Hook was published. In 1897 Bovée, in reporting a personal case, collected 12 cases of ureteral anastomosis from the literature, two of which must however be discarded. He materially modified the method of Van Hook. The following method classification of uretero-ureteral anastomosis, together with exponents of each method, tabulated by Markoe and Wood²⁵ is excellent:

- I. Transverse end-to-end. $\left\{ \begin{array}{l} (a) \text{ Without support. Schopf, Hoch-} \\ \text{enegg, Cushing.} \\ (b) \text{ With support, Tauffer.} \end{array} \right.$

II. Oblique end-to-end. Bovée.

III. Invagination. { (a) Without support. (1) Ureter not split.
Poggi.
(2) Ureter split to invaginate. Mayo Rob-
son, Winslow.
(b) With support. Markoe.

IV. Lateral implantation. Van Hook, Kelly, Emmett, Doherty.

No inconsiderable ingenuity has been displayed in the effort to overcome the hiatus caused by an excessive loss of ureteral substance. Thus Bovée,²⁶ based upon successful experimental work on two dogs, advises dislocation of the kidney downward, with suturing in its new bed subsequent to the completed anastomosis. Monari believes that the ureter may be attached to the abdominal wall under considerable tension, and when time has produced the required length, a lateral anastomosis may be attempted. Rydygier suggests implanting the severed ends on the abdominal wall and connecting them by a duct lined with skin; while Van Hook would elevate a flap from the bladder, develop a diverticulum and so bridge over the space to the proximal end of the ureter.

At the close of this chapter of ureteral surgery none of these suggestions had been performed on man; and the choice rested between implantation into the bladder, bowel, or skin.

II. *Anatomy of the Ureter.*—For an exhaustive study of the anatomy of the ureter search must be made through various monographs which discuss the theme. The following points will, however, prove germane to the subject in hand, and will be helpful in the final analysis: The adult ureter ranges from 25 to 40 cm. in length, while the outside diameter may be said to be 3 to 4 mm.; yet the fact remains that both the outside diameter and lumen vary considerably owing to curvings and sacculations that are fairly constant. The course of the ureters is not regular nor symmetrical. So far back as 1869 Freund and Joseph²⁷ showed that the left ureter is nearer the mid-line and as a rule nearer the uterus and its cervix. Crossing the common iliacs they are from 5.7 to 7 cm. apart; then following the pelvic curve they separate until

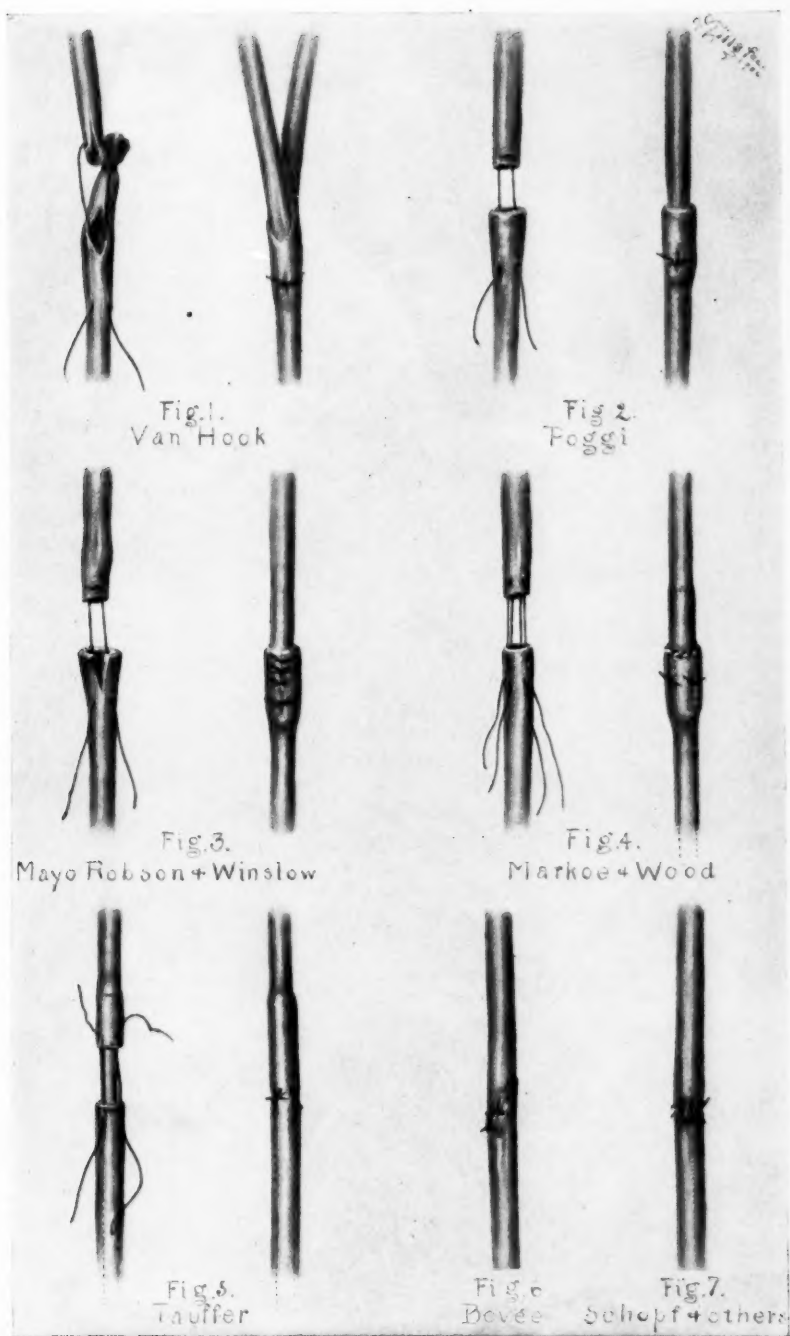
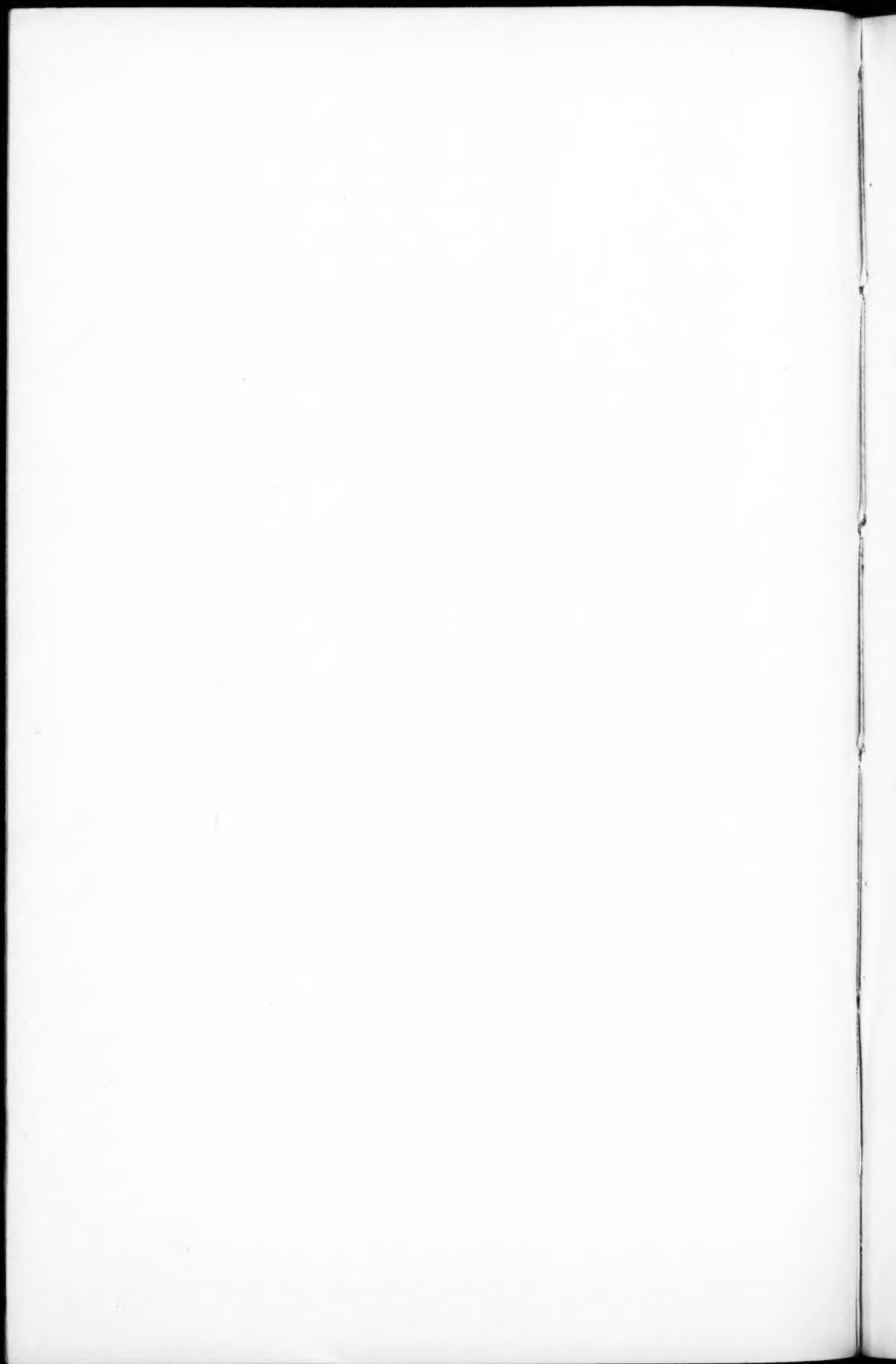


PLATE I.—Various methods of ureteral anastomosis, with their advocates.*

* Dr. Mills has here portrayed certain steps and the end results of actual anastomoses of the human ureter made by him for this plate. It is probable that, even with the reduction necessary to make a full-page plate of the ANNALS OF SURGERY, the dimensions will remain slightly in excess of the normal ureter.



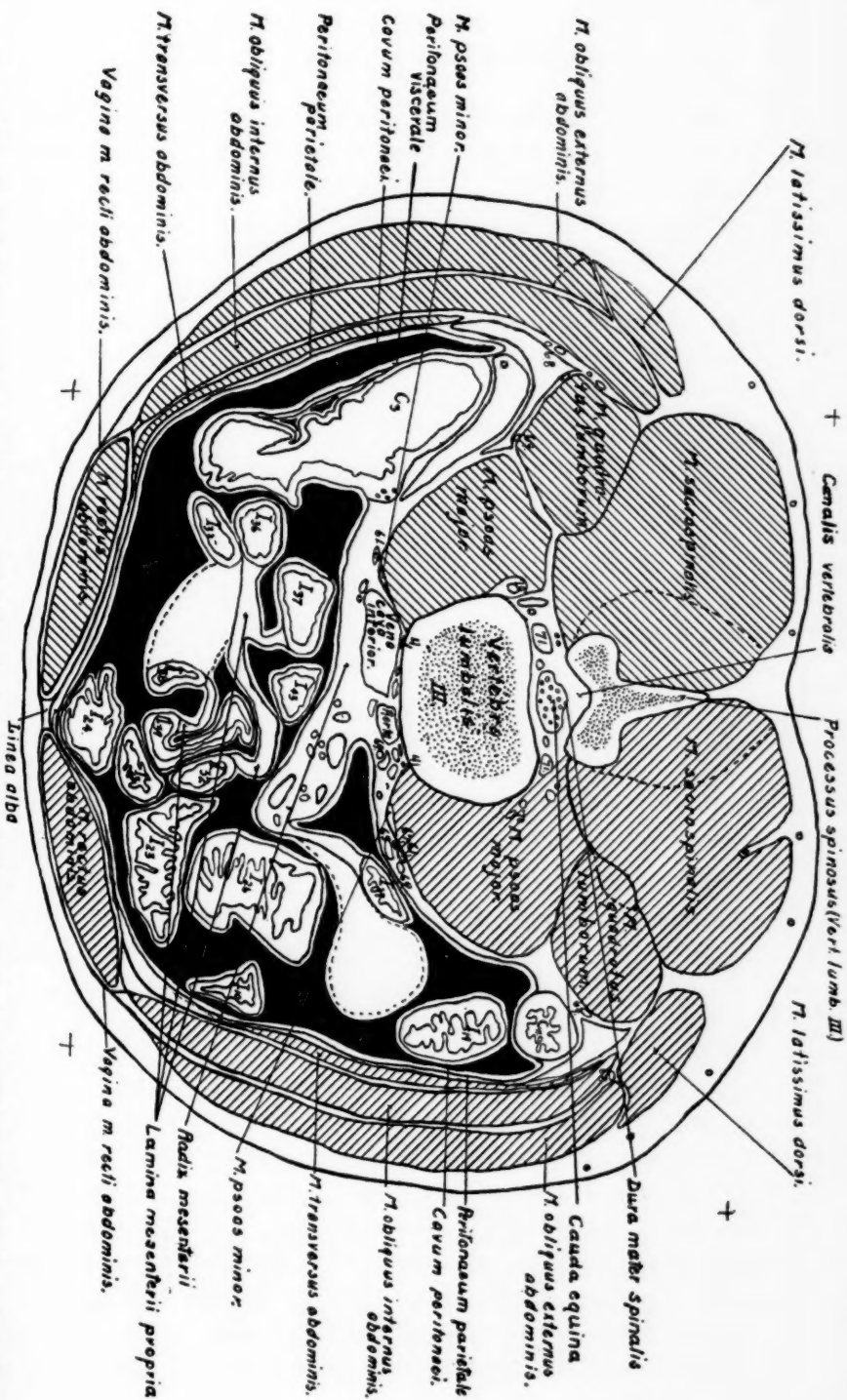


PLATE II.—4. N. sympathetica. 61. Ureter. 65. V. mesenterica inferior. 67. A. and V. spermatica interna. 68. N. thoracica XII. 69. N. lumbalis I. 70. N. lumbalis II. 71. N. lumbalis III. 73. N. lumbalis IV. 74. N. obturator. 75. N. cruralis anterior. 77. Chorda lumbosacralis. 78. N. sacralis I. 79. N. sacralis II. 80. N. sacralis III.

* For the use of Plates II, III, IV, and V, I am indebted to the courtesy of Dr. Peter Potter, Associate Professor of Anatomy, medical department of St. Louis University. These plates are direct tracings from transverse sections of the human body of the thickness of a vertebra: portion of an admirable series made by Dr. Potter and published, "Topography of the Thorax and Abdomen," "University of Missouri Studies," Columbia, Mo., 1905. The additional notations made above hold good throughout the four plates.

2 to 3 cm. below the iliacs, from 10 to 13 cm. intervenes; at line of the internal os, 9.8 cm. apart; on entering the bladder, 2.7 to 3.5 cm. apart. The distance between the external os and the right ureter, 2.5 to 3.3 cm.; the left ureter, 1.5 to 2.7 cm. Luschka²⁸ and Holl²⁹ give measurements which vary somewhat from the above, but agree as to the asymmetry ordinarily encountered. Quenu and Duval have suggested as a valuable landmark in identifying the lower ureter the bifurcation of the common iliac artery. The right ureter will be found 1 cm. external to the bifurcation and crosses the iliac vertically, while the left ordinarily is exactly upon the bifurcation. The ureter is composed of three layers. The outer coat is fibrous; the middle coat is muscular, whose thin smooth longitudinal folds manifest some tendency to stratification; the intima is mucous. The muscular coat, inducing a fairly rhythmic peristalsis, is assisted by the force of gravity in establishing the cloacal function of the ureter. Waldeyer³⁰ has directed our attention to the fact that certain longitudinal bundles extend from the bladder out on the ureter. These are united by connective tissue, and separated from the ureter proper by a space which he considers a lymph-space. This sheath ranges from .5 to .75 mm. in thickness, and extends within the ureter from 3 to 4 cm. Disse, however, claims that these bundles do not arise from the bladder, as might be inferred, but from the ureter, and thinks it probable that their hypertrophic condition, together with the subjacent space, follows vesical contractions exerting traction on the outer ureteral coat. There is, in addition to this sheath of Waldeyer, a second fibro-muscular covering which, starting upon this structure and somewhat intimately blending with it, continues upward. Between this sheath and the ureter proper are found fine fibrous fascicles and adipose tissue, which as has been suggested by Sampson may subserve the function of a cushion protecting the ureter. It is a moot point as to whether true lymphatic spaces exist in this tissue. Sampson has also directed attention to the contractile mobility of the ureter within this sheath, its protective influence against inflammatory and malignant extension processes, and that within its

embrace is found the periureteral arterial plexus. The lymphatic system is well developed and found within the different layers. The blood-supply of the ureter is drawn from branches of the renal, spermatic, utero-ovarian, internal iliac, inferior mesenteric, middle hemorrhoidal and inferior vesical arteries; while its veins, with apparently no prevailing rule, empty into neighboring vessels. Disse has shown that the pelvis of the kidney draws its blood-supply from a branch of the renal artery which courses down over the abdominal ureter; this section also derives nourishment from the spermatic. The pelvic section owes its main supply to the middle hemorrhoidal and inferior vesical arteries. In general it may be noted that these trunks parallel the ureter, to which they are attached by connective tissue. From these parallels arise at comparatively frequent intervals branches which, piercing the muscularis, still further divide within the intima into longitudinal sub-branches found fairly constantly from the kidney to the bladder. Capillary systems to the epithelium and muscularis are the terminals of the arteries of the propria. From these systems the venous current is carried through a plexus, largely longitudinal, inside the muscularis. This venous plexus of the intima empties into channels within the adventitia, which parallel the arteries. Probably the most valuable of our anatomic assets of comparatively recent acquisition is the periureteral arterial plexus, whose orientation has been so felicitously accomplished by Sampson.³¹ He has shown that from the aorta, the renal, ovarian, iliac, uterine, etc., arteries arise branches which may be styled uretero-subperitoneal arteries. These arteries ordinarily divide into two branches; first, an ureteral branch which helps to form the periureteral arterial plexus; second, a subperitoneal branch, which supplies the tissue contiguous to the ureter.

1. The ureteral arteries on reaching the ureter divide into ascending and descending branches, both paralleling the ureter and united to it by a loose fibrous tissue; a free anastomosis exists between the ascending and descending sub-branches. Thus, enveloping the ureter, is found a longitudinal arterial system, whose offshoots abundantly anastomose, extending

from the kidney to the bladder. From these large trunks smaller branches arise which imbed themselves somewhat more deeply in the perimuscular fibrous tissue of the ureter than do the stems; and these, too, anastomose, thus forming with the main trunks a periureteral arterial plexus extending the entire length of the ureter up over the pelvis of the kidney and still accompanying the ureter as it pierces the bladder-wall. From this plexus still smaller vessels arise which penetrate the walls of the ureter; and yet other channels are found which, leaving the ureter, supply the adjacent tissues, and even these may anastomose with branches of other vessels supplying these parts.

2. The subperitoneal divisions of the uretero-subperitoneal vessels supply the tissues adjacent to the ureter and also, in places, the peritoneum. These may anastomose with each other and with branches from neighbouring vessels including branches from the ureteral plexus, and thus may serve as a source of nourishment to the ureter. And yet other sources exist; for the uterine and vesical arteries of one side anastomose with those of the other, and in addition there is a free anastomosis between the uterine and ovarian arteries; and again the branches of the latter anastomose with branches from the renal. The periureteral arterial plexus thus is shown to receive its blood-supply from definite ureteral arteries, and may be nourished indirectly through the anastomosis of these arteries and branches from the plexus itself with the branches of vessels supplying the tissue circumjacent to the ureter.

Sampson has also shown that in the dog the ureter will withstand extensive manipulation even to stripping with the finger nail, or freeing throughout its entire length, and no untoward effect will follow provided a sufficient number of nutrient vessels remain intact to preserve the integrity of the ureter. [Of interest at this point is the record of Margaroucci⁸² that he isolated the entire ureter in ten dogs; in none necrosis followed. He, too, explains this fact by the existing arterial supply with its numerous anastomoses. He claims that the supply from the renal artery alone is almost sufficient

to nourish the entire ureter. Durante³³ accomplished the same feat on a woman, where the ureter was involved in a gigantic cystadenoma of the broad ligament.] And on the other hand manipulation which destroys the periureteral arterial plexus even though far less severe than in the former instances, will as a rule, so impair the vitality of the ureter that necrosis will supervene. He concludes that when the integrity of the ureter is impaired, as by malignant invasion, and choice remains, resection with end-to-end anastomosis or a vesical implantation is preferable to any method which demands a stripping so severe as to imperil the function of the periureteral arterial plexus.

III. *Indications for Ureteral Anastomosis.*—The indications for an ureteral anastomosis are sufficiently obvious to justify the omission of special narration and discussion. In brief: 1. Any condition in an operative attack within the abdomino-pelvic area which necessitates an interruption of the continuity of the ureter will demand consideration for the restoration of the integrity of the urinary channel. 2. Operative casualties occurring within the abdomino-pelvic area which seriously impair or destroy the continuity of the ureter. 3. Any pathologic condition existing in the abdomino-pelvic area which so encroaches upon the ureter, whether by extension or pressure, that its function is seriously handicapped or destroyed.

These three classes will be found to include the majority of cases coming under observation. Pathologic conditions associated with calculi, fistulas, etc., are largely of collateral importance. The more commonly employed means for solving the difficulty have been implantation in bowel, bladder, or skin, and uretero-ureteral anastomosis. Nephrectomy of the crippled side should, with justice, be definitely eliminated from the list of restitutorial methods, for the impaired ureter is neither restored nor so transferred that its cloacal functionation may continue; and in addition the kidney, which at this point in the patient's career has but a collateral significance, is ablated. As well might one class an amputation following frac-

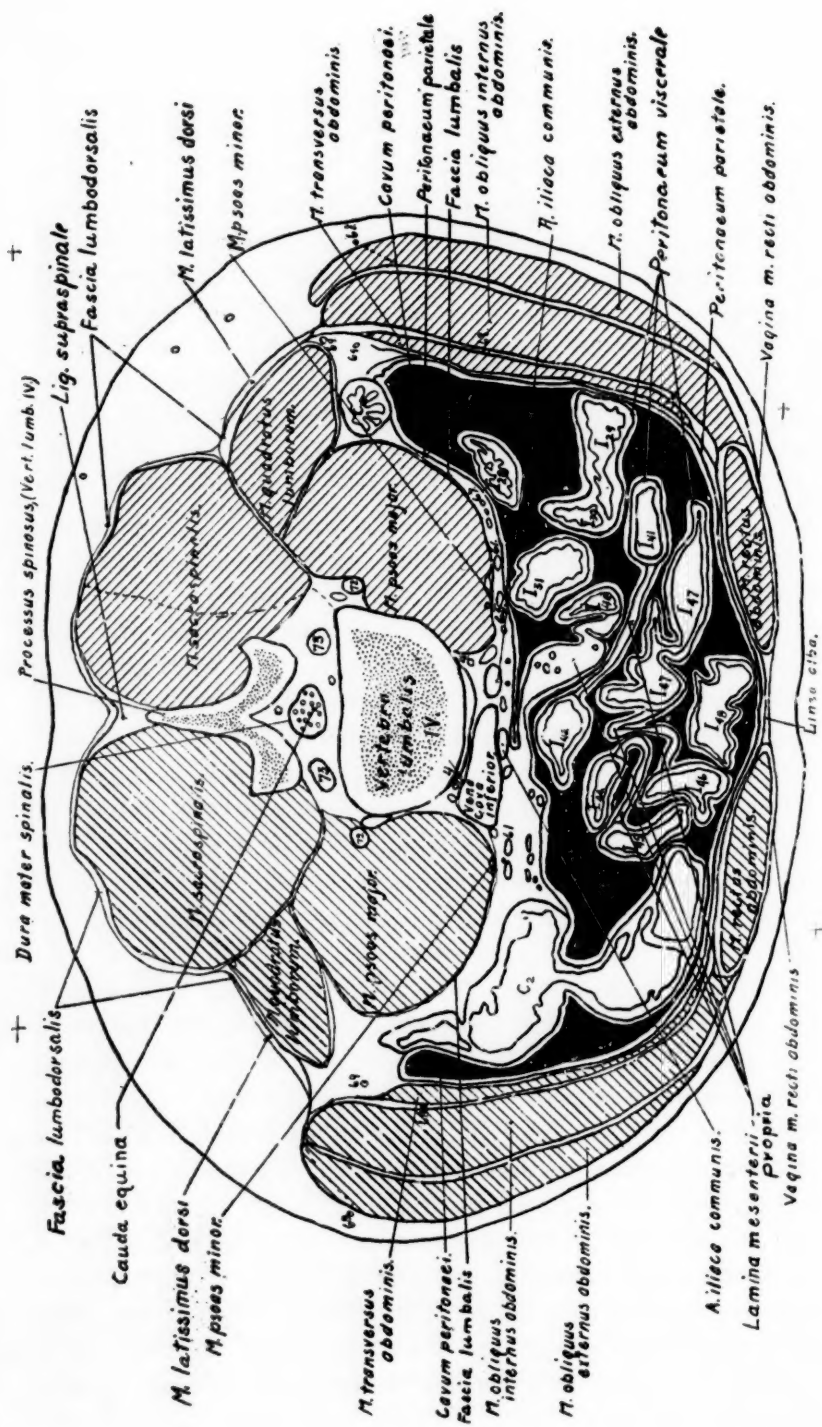


PLATE III.

ture as a restitutorial measure. Ligation of the proximal end of the ureter with induced hydronephrosis and subsequent cessation of nephric function (corroborated by the experimental work of James ⁴⁰) should also be excluded; for while the operative work is obviously less perilous than a primary nephrectomy, the end result is analogous—the patient is deprived of the use of his kidney. But this analogy is not complete, for it is impossible to state the actual effect upon the organism when a kidney is thus abruptly thrown out of function and an infection atrium may be found existent at any point between the kidney capsule and the ligature encircling the distal end of its ureter. That the remaining kidney may be seriously crippled,—indeed, absent; that such conditions are all too frequently not ascertained previous to an abdominal operation; that it is most difficult to obtain exact information in the stress of so serious an operative casualty as a cut ureter, when time is priceless, seem to be statements of facts so vitally patent as to demand no further discussion, yet that imperatively indicate restitutorial rather than destructive surgical measures. Of these various restitutorial measures, we are, in this discussion, concerned with but the last,—ureteral anastomosis.

IV. *Methods*.—Consideration of the methods scheduled in Section I. will show that the general plan of procedure does not vary in any vitally essential detail.

In Groups I. and II. apposition of extremities is direct, transverse or oblique, with or without support.

Group III. Apposition of extremities is by direct invagination, with or without splitting of segment, with or without support.

Group IV. Apposition of the extremities by lateral invagination, without support.

In Groups I. and II. Outer, middle and inner coats come into direct contact with their several fellows of the other segment.

In Groups III. and IV. The middle coats do not appose each other, but contact is permitted between the outer sheath

of the male segment and the inner coat of the female, save when the outer sheath of the male segment has perchance been liberally scarified,—it then may be assumed that the muscularis of the male segment would be brought in apposition with the intima of the female. A modified Jobert's invagination suture seems to have been most commonly employed.

V. *Personal Work*.—It may be readily conceived that a lateral spinal deflection would so seriously alter ordinary anatomic relations that any one of these excellent methods would prove technically difficult, if not actually impossible.* And again so large a section of the ureter may be lost, whether as a result of pathologic involvement or surgical intervention, that here also a similar difficulty, or impossibility, would be confronted. With these matters under consideration, and in search of a method that might prove efficacious, in 1900 was devised and performed on two dogs the lateral invagination of the proximal end of one ureter into its fellow. In my "Data of Experiments" this procedure was designated "Intraperitoneal trans-uretero-ureteral anastomosis." The first point to be oriented was, Is the conception an anatomic possibility? the second, Is it a physiologic success? The following notes (heretofore unpublished) show:

Experiment I.—Nov. 26, 1900. A small mongrel cur was anesthetized, the left ureter, through a median incision, isolated, divided, the lower segment ligatured and dropped, the upper clamped; the right ureter isolated, a suitable longitudinal incision made, a modified Jobert's invagination suture (fine silk) placed in anterior face of proximal extremity of left ureter, the mesentery perforated close to its root and at an appropriate level, and the left ureter drawn through the longitudinal incision of the right, by means of the two suture ends which were then caused to transfix the three coats of the right ureter below the lower angle of the longitudinal

* Cognate to these personal statements are the observations of Bologna (III Cong. Dell' Ass. Nazionale dei Med., 1905). Among widespread changes developed concomitant with, or sequent to, a scoliosis, he notes that the kidney also suffers, the one on the invaded side being sometimes laterally compressed between the vertebral column and the chest-walls, while the kidney on the concave side hypertrophies. The contracted psoas may so close the lumen of the ureter as to develop an hydronephrosis.

incision. This suture was tied, also three others, one inserted at the upper angle formed by the junction of the ureters, and two, to snugly close the incision, above the junction, which had been made a trifle too long. The lines of junction were covered by a fold of mesentery appropriately sutured.

No special postoperative occurrences. The dog lived eighteen hours. Autopsy showed a competent anastomosis, with no leakage nor ballooning of either ureter or kidney pelvis; no evidence of peritonitis. There was urine in the bladder. The mercurial manometer showed that the anastomosis suture lines withstood up to a pressure of 60 mm. of mercury, at which point leakage followed.

Experiment II.—Dec. 13, 1900. A small mongrel dog was anesthetized and again the proximal end of the left ureter invaginated laterally, through a longitudinal incision, into the right. The technical details of this experiment differed in no essential from those noted in *Experiment I.*, save that no additional sutures were required to close the longitudinal incision, and two additional sutures were inserted laterally at the spread of the longitudinal incision, made by the inserted ureter, in order to more snugly approximate the union. The mesentery was sutured over the anastomosis. The dog lived forty-eight hours. Autopsy showed a competent anastomosis with no leakage, nor ballooning of either ureter or kidney pelvis; no evidence of peritonitis. The bladder contained urine. The mercurial manometer showed that the anastomosis suture lines would withstand up to 50 mm. of mercury, at which point leakage occurred.

These experiments were carried out under adverse conditions, in that facilities were not to hand for suitable post-operative care of the dogs. After consideration of the autopsy findings, of which the essentials have been given, both Dr. Budgett (late Professor of Physiology, Medical Department, Washington University), who most kindly assisted me and to whom my thanks are due, and I were strongly inclined to the belief that death followed in both experiments from these conditions rather than from any factor directly attributable to the operations.

Conclusions.—I. These experiments have proved that an intraperitoneal trans-uretero-ureteral anastomosis is an anatomic possibility.

One dog lived eighteen hours, the other forty-eight hours; within these brief periods union sufficient to withstand up to 60 mm. and 50 mm. (mercurial manometer) respectively had been secured. Neither hydronephrosis nor hydro-ureter was

in evidence. Urine was within the bladder. It would seem, therefore, even within the limitations above noted that

II. An intraperitoneal trans-uretero-ureteral anastomosis is a physiologic success.

These experiments were not recorded in the literature and nothing further was attempted along this line of research until March, 1906, when the following procedures were devised and executed on the cadaver. The reasons for altering the above plan of operative attack were, in brief, that it was apparent that if a technique could be constructed that would more nearly protect the ureter from injury and from involvement with other abdominal structures, and in addition conserve and perchance add to its normal blood-supply, a distinct stride in advance would have been measured. These conclusions were based upon a not more than conventional comprehension of the blood-supply of the ureter. They were, however, confirmed when the masterly exposition of the blood-supply of the ureter by Sampson was given to the surgical world. The technical difficulties of the work, hereinafter described, were greatly augmented by the fact that the cadaver subject was not less than eighteen months old and had undergone several periods of drying and moistening, with the result of both tissue rigidity and brittleness.

Experiment III.—Through the anterior abdominal wall (which had previously been opened in the mid-line) the field was so cleared by laying aside obscuring structures that the courses of the ureters were developed. A suitable longitudinal incision through the peritoneum over the right ureter, and its isolation, above the promontory of the sacrum, were made. Retracting the ureter laterally, a retroperitoneal dissection, largely by the finger, but assisted occasionally by the handle of a scalpel, was made toward the mid-line, penetrating in the layer of connective tissue between the inferior vena cava and aorta posteriorly and the peritoneum anteriorly, until the left ureter was reached and identified. After liberating this for a sufficient distance it was brought across to its fellow, incised, the distal extremity released, and a lateral invagination through a longitudinal incision in the right ureter was made as detailed in Experiments I. and II. When the anastomotic area was released and the peritoneal edges of the longitudinal incision approximated, the entire field of manipulation was found to be wholly retroperitoneal. The difficulty of accomplishment was not excessive, and the ureters showed no evidence of undue tension.

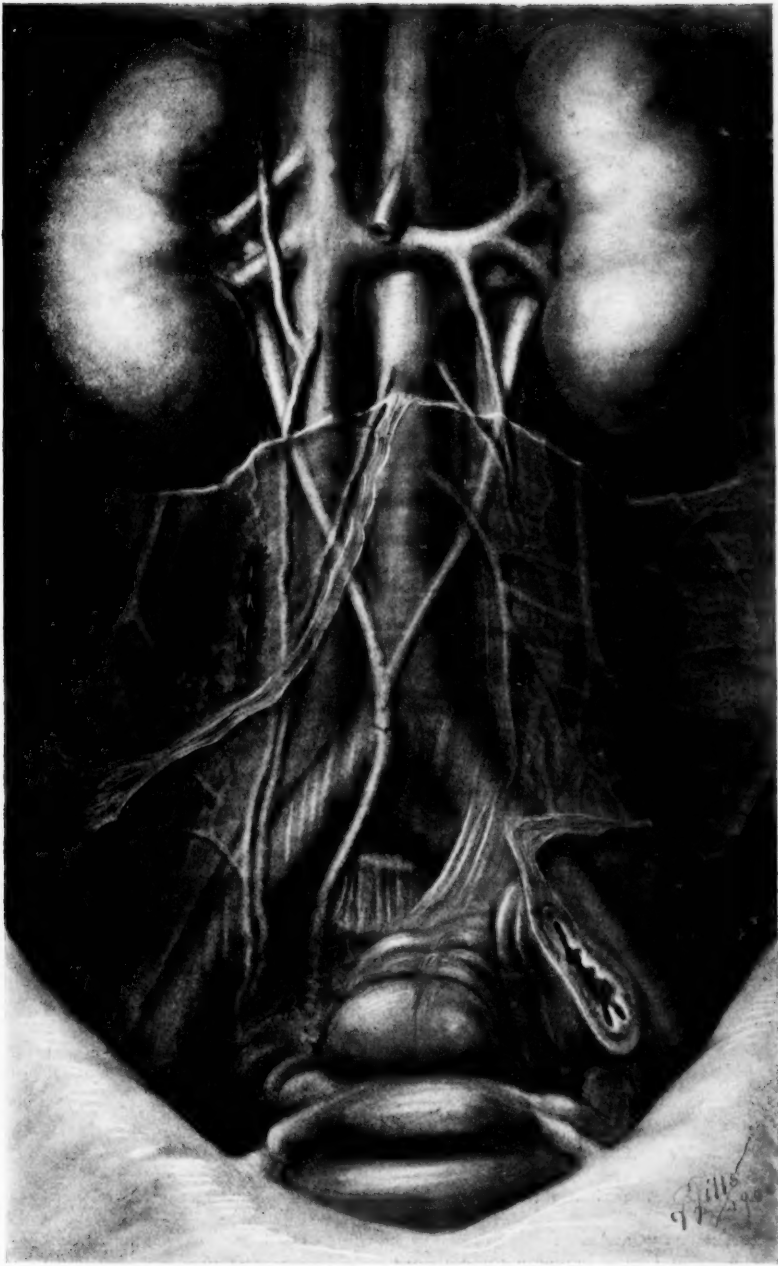


PLATE VI.—Retroperitoneal trans-uretero-ureteral anastomosis. Anterior to aorta and vena cava.

A tendency for the sound ureter to approach the mid-line is to be noted; this is due in part to its new attachment to its fellow, in part to its segmental release from its original bed. The distal stump of the left ureter is not shown. Peritoneum has been removed over the kidney, but portrayed transparent over anastomotic area.

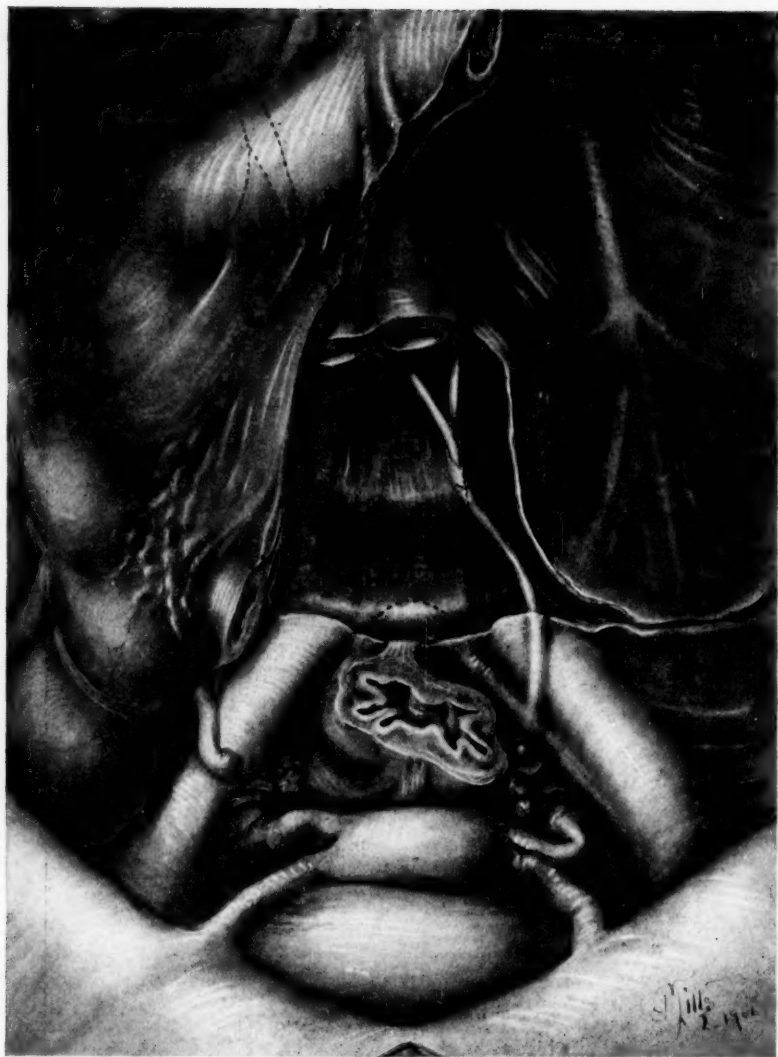


PLATE VII.—Retroperitoneal trans-uretero-ureteral anastomosis. Posterior to aorta and vena cava.

Peritoneum, aorta, and vena cava removed to show ureters and their relation to vertebral column. The distal stump of the right ureter is not shown.

Experiment III. proved that a retroperitoneal trans-uretero-ureteral anastomosis is an anatomic possibility.

Realizing, however, that a more direct route might be available, and that various conditions, such as a lodosis or a relatively extreme depth of the lateral abdominal fossæ, would make such a route highly valuable, the following procedure was performed:

Experiment IV.—The sutures of the above noted anastomosis were liberated and the two ureters replaced in their normal positions. Through the same longitudinal incision over the right ureter a dissection was made toward the mid-line and passing between the vertebral column posteriorly and the vena cava and aorta anteriorly the left ureter was reached and again withdrawn to its fellow, and again invaginated in the existing longitudinal incision by the method followed in the former efforts. When the anastomotic area was released and the peritoneal edges of the longitudinal incision approximated, the entire field of manipulation was found to be wholly retroperitoneal. In this instance, also, the difficulty of accomplishment was not excessive. It was also readily seen that owing to the shorter route traversed the ureters, whose liberated areas had not been extended over those of Experiment III., had gained demonstrable laxity.

While retroperitoneal trans-uretero-ureteral anastomosis, whether anterior or posterior to vena cava and aorta, is admittedly more difficult of accomplishment than intraperitoneal trans-uretero-ureteral anastomosis, yet it must be conceded that owing to the shorter hiatus to be bridged, with proportionately less disturbance of the ureters and their blood-supply, their probable subsequent vitality and power of functionation are enhanced in conformity with the postulates of Sampson. It is also probable that owing to the replacement of the ureters within beds which are closely allied to, if not in fact actually identical with, their normal surroundings, the interference with their blood-supply will be reduced to the minimum; and the possibility of nourishment to be derived from contiguous connective tissue and the peritoneal covering must not be ignored.

Beyond the technical difficulties inherent to such manipulations, and the necessary time involved, possibly superimposed upon other operative measures (both of which may, however,

be diminished by practice), the query which will, in all probability, most readily spring to the mind is, whether or not sufficient pressure will be exerted by the aorta and vena cava to materially interfere with the patency of the transferred ureter (or the anastomotic area itself, if it should happen to be the point in contact). It is conceded that Experiments III. and IV. prove merely the anatomic possibility of a retroperitoneal trans-uretero-ureteral anastomosis, respectively ante-aortocavic and ante-vertebral. Suitable material has not as yet been secured for demonstrating if these procedures be physiologic successes. But in support of such an hypothesis may be adduced the well-known physiologic fact that a tube with well-defined mural structure which exhibits an intratubular pressure, whether constant, periodic or occasional, is able to maintain its patency though extramural pressure be maintained. The rectum clamped between the sacrum and an augmenting pelvic fibroid is a fairly familiar example; the vena cava and the left common iliac vein fixed between the vertebral column and the aorta and right common iliac artery, is another. These examples are specially interesting, for in the former an intratubular pressure exists only during evacuation of, or when the rectum is filled with, *fæces*; and in the latter it is known that dependent largely upon intrathoracic conditions the intracavic pressure varies from an actual negative to but a few millimetres of mercury, while the diastolic and systolic aortic pressures presumably somewhat exceed the brachial pressures, which are 75 to 100 and 100 to 150 mm. respectively. In other words, the patency of a compressed tube may remain even though the constricting force be in excess of its own intratubular pressure. The intraureteric pressure reaches 60 mm. of mercury, beyond which an hydro-nephrosis threatens.

While from a purely controversial standpoint it might be inopportune to allude to the increase of ureteric pressure which follows when a constricting force is permitted to exert itself, yet clinically we are compelled to concede that this increase of intratubular pressure but enhances the probability of maintenance of patency.

In the final survey of the literature of ureteral surgery before closing this article, it was discovered that the proceedings of Experiments I. and II. carried out independently by myself in November and December, 1900 (not hitherto recorded), had been in all essentials paralleled by the following workers:

1894. BOARI and CASATI³⁴ tried uretero-ureteral anastomosis on the dog on eight occasions. The mesosigmoid was perforated; approach was gained both by the anterior abdominal route and also a lateral extraperitoneal route, of which close details are lacking. All dogs, save one, died within two or three days after operation. This one died from peritonitis with urinary infiltration on the eighth day. The anastomosis had yielded at one point.

1895. MONARI³⁵ followed the same method on the dog 13 cm. from the bladder. "At the end of a certain time," the dog was killed; stenosis of the ureter at point of penetration of the mesosigmoid found; no stenosis at site of anastomosis; hydro-ureter and ballooning of the kidney pelvis existed. He concludes that the operation may be made in man, in certain cases of urinary fistulas, in place of more serious procedures, and that no danger would follow if the ureter be replaced in "its fatty capsule."

1896. WISSINGER³⁶ presented before the Medical Society of Hamburg "a beautiful specimen," but so far as the literature shows failed to mention either source or method.

1905. FREUND³⁷ records that he implanted, in a bitch, the proximal end of an ureter in a fallopian tube; the other end of the tube was then connected with the bladder. Mention is made that a similar plan was followed by D'Urso and de Fabii. After stating that transureteral anastomosis had been suggested as a possibility by Kelly, McMonagle and Sampson, he describes having cut a ureter in a dog; its central end was drawn by ligatures through the mesentery, and laterally attached by two sutures to its fellow; six silk sutures were utilized in completing a lateral anastomosis.

1905. BERNASGONI and COLUMBINO³⁸ performed uretero-ureteral anastomosis on ten dogs, both near the bladder and in the lumbar region. They believed that they were the first to successfully penetrate the mesentery. They direct attention to the fact that in the dog so loose is the posterior peritoneum that the ureter is furnished with what is practically a mesoureter; this, in particular, holds in the vicinity of the bladder. Eight of their cases were near the bladder, lateral implantation between two retention sutures; continuous sutures were employed, which were covered by a Lembert of the peritoneum. Three dogs died; five perfect results determined at end of three to four months. Two cases were transmesenteric at height of the umbilicus; ureters were found over the psoas, and anastomosis was made by the former method, save that the

mesentery was perforated. The first dog died of peritonitis on eighth day; no leakage noted. The second survived. Autopsy at three months; result excellent.

So far as known the work detailed in Experiments III. and IV. has not been duplicated.*

VI. *Chronology*.—The following chronologic table of the development of the surgery of the ureter outlines in sequence the rather more essential steps that have led up to the present-day work in uretero-ureteral anastomosis. It also includes the latest experimental work, so far as known:

- 1851. *Simon*.—Extraperitoneal uretero-rectal anastomosis.
- 1876. *Nussbaum*.—Extraperitoneal uretero-rectal anastomosis.
- 1879. *Smith*.—Extraperitoneal uretero-rectal anastomosis.
- 1886. *Schopf*.—Transverse, end to end, without support.
- 1886. *Poggi*.—Invagination, end within end, without support.
- 1892. *Van Hook*.—Invagination, lateral, without support.
- 1894. *Boari and Casati*.—Intraperitoneal trans-uretero-ureteral anastomosis,—dog.
- 1895. *Monari*.—Same method,—dog.
- 1897. *Bovée*.—Oblique end to end.
- 1900. *Sharpe* (Nov. and Dec.).—Intraperitoneal trans-uretero-ureteral anastomosis; lateral invagination,—dog.†
- 1905. *Freund*.—Implanted the proximal end of ureter in a Fallopian tube. The other end of tube was then implanted in the bladder. (States that D'Urso and de Fabii had also accomplished the same.) In addition records a lateral intraperitoneal trans-uretero-ureteral anastomosis,—dog.
- 1905. *Bernasgoni and Columbino*.—Intraperitoneal trans-uretero-ureteral anastomosis,—dog.

* I desire to acknowledge, with appreciation, the courteous assistance and valuable coöperation, tendered me by Dr. Robert J. Terry and Dr. Vilray P. Blair, respectively Professor of Anatomy and Associate Professor of Anatomy in the Medical Department of Washington University.

† Not hitherto published.

1906. *Sharpe* (March).—Retroperitoneal trans-uretero-ureteral anastomosis, lateral invagination,—cadaver.

(a) Anterior to aorta and vena cava, posterior to peritoneum.

(b) Anterior to vertebral column. Posterior to aorta and vena cava.*

VII. *Conclusions.*¹—

I. The blood-supply of the ureter is ample, of which probably the peri-ureteral arterial plexus is the most essential factor.

II. Operative procedures which conserve the blood-supply, in particular the peri-ureteral arterial plexus, are ordinarily satisfactory.

* Of very great interest, in connection with the problems incidental to wounded ureters or such other conditions that may tempt the operator to find a solution in a nephrectomy, is the work of Carrel, Floresco and others in organ-transplantation. They have most ingeniously devised and successfully executed plans by which the kidney, heart and other organs, removed from their normal site and transplanted elsewhere, have continued functionation. The three natural subdivisions of auto-transplantation, homo-transplantation and hetero-transplantation—have received consideration and experimental work is of record. This suggestive research is pregnant with possibilities for future development. For details see:

Carrel. La technique opératoire des anastomoses vasculaires et la transplantation des viscères. Lyon Medical, 1902.

Carrel. Les anastomoses vasculaires; leur technique opératoire et leurs indications. Le Congrès des Médecins de la langue Française de l'Amérique du Nord. Montreal, 1904.

Floresco. Conditions de la transplantation du rein. Recherches sur la transplantation du rein. Jour. de Physiol. et de Pathol. générale, 1905.

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Carrel. Transplantation of Organs. Jour. Am. Med. Assn., 1905, vol. xlv, p. 1645.

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Carrel. Anastomosis and Transplantation of Blood-vessels. American Medicine, 1905, August.

Carrel and Guthrie. The Reversal of the Circulation in a Limb. ANNALS OF SURGERY, 1906, v. xliii, p. 203.

III. When the integrity of the ureter is impaired, restitutive rather than destructive surgical measures should be followed.

IV. Of which restitutive measures the various methods of uretero-ureteral anastomosis are recommended.

V. Intraperitoneal trans-uretero-ureteral anastomosis is an anatomic possibility; it is also a physiologic success.

VI. Retroperitoneal trans-uretero-ureteral anastomosis, whether anterior or posterior to the aorta and vena cava, is an anatomic possibility. (Further experimentation is essential in order to prove that it is a physiologic success.) The route followed is the shortest path between the two ureters. The technical difficulties are not excessive. It is highly probable that this method impairs the ureteric blood-supply less than any other method in vogue.

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TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY

Stated Meeting held June 4, 1906.

DR. ROBERT G. LE CONTE in the chair.

GENERAL PURULENT PERITONITIS.

DR. GEORGE G. ROSS reported eight cases of generalized peritonitis, as follows:

CASE I.—Miss Alice H., aged twenty-one, was admitted to the German Hospital, August 18, 1905, with the history that for twenty-four hours before admission she had suffered with severe abdominal cramps, starting in the right iliac fossa, later becoming general, and accompanied with nausea and vomiting; bowels open. On admission, her abdomen was distended and moderately rigid. There was general abdominal tenderness, with the greatest intensity over the appendix region. By the following day, the distention, rigidity, and tenderness were markedly lessened, the bowels had moved, and flatus was passed freely. On the second day, the symptoms had become localized to the right iliac fossa, and on the following day, the third after admission, she was operated. The leucocyte count on the day of admission was 16,200; and on the day of operation, 14,800.

On opening the peritoneum, a thin, blood-streaked pus was found to the outer side of the cæcum and in the pelvis. The abscess cavity was not confined, however, to these localities; as there was infection of the greater part of the general peritoneal cavity.

No attempt was made to remove the appendix. She was thoroughly drained by a glass tube in the pelvis, a rubber tube in the loin, and gauze wicks. She lived sixteen days. On the

fifteenth day, the leucocyte count showed 13,400. On the day of her death, she expectorated a large quantity of fetid pus.

Post-Mortem Report.—Plastic peritonitis about the site of the appendix; a large abscess between the right lobe of the liver and the diaphragm, which had ruptured into the right pleural cavity, and thence into the right lung. The pathological diagnosis was septic bronchopneumonia.

CASE II.—Miss Annie C., twenty years of age, was admitted to the German Hospital September 27, 1905, with an acute attack of appendicitis of twenty-four hours' duration. There was some general distention and tenderness. The point of greatest tenderness was over the right iliac fossa, extending outward to the crest of the ilium. Vomiting and pain were severe and persistent. The leucocyte count was 24,800.

Operation was performed on the day of admission. On opening the peritoneum, free pus escaped. The peritoneal cavity was walled off with gauze-pads, in the hope that the peritonitis was diffused, but not general. When the gauze was removed it was saturated with pus, proving that the general cavity had been invaded. The appendix was removed, and the peritoneal cavity drained with a glass tube in the pelvis and three pieces of gauze. It was not irrigated. Fowler's position and rectal transfusion were used. There was an uninterrupted recovery.

CASE III.—Mrs. Ida A., twenty-eight years of age, was admitted to the German Hospital August 12, 1905, with an attack of acute appendicitis that had begun three days before, but had become severe only the day before admission. The abdomen was distended, tender, and rigid, the tenderness being exquisite over the right iliac fossa, and the rigidity most marked in the lower quadrant of the abdominal walls. There was no palpable mass. The leucocytes amounted to 5,650.

Operation was performed on the day of admission. An incision was made through the right rectus. There was free pus in the peritoneal cavity, in large quantity. The appendix was removed, and found to have perforated, liberating a fecal concretion and pus. The peritoneal cavity was thoroughly washed with sterile salt-solution, and glass drainage was introduced into the pelvis. A counter opening, to the outer side of the rectum, was made for gauze drainage to the bed of the appendix. Fowl-

er's position was used, together with salt-solution by the bowels, every four hours, a pint being used each time. The patient made an uninterrupted recovery.

CASE IV.—Mr. K., twenty-six years of age, was admitted to the German Hospital August 17, 1906. He had been sick two days with an acute attack of appendicitis exhibiting the classical symptoms and signs.

On admission, his abdomen was moderately distended, with bilateral rigidity and tenderness—most marked, however, over the appendix. On the following day, the abdomen had become softer and less distended, and a mass could be mapped out toward the right iliac crest. The leucocyte count was 16,100. The man was operated upon on the fourth day after admission.

The peritoneal cavity, which was infected, was packed with gauze. A localized abscess to the outer side of the cæcum was opened. The appendix, which was gangrenous, had perforated, liberating three concretions. It occupied a position behind the cæcum, running upward toward the liver. It was removed. There was about 250 c.c. of foul-smelling pus in the pelvis, yellowish-white in appearance, and thin in consistency. Drainage was secured with a glass tube and gauze.

The patient lived but twenty-four hours after the operation, profound and continuous sepsis being the cause of death. The postmortem showed a secondary abscess beneath the liver, and fibrinopurulent peritonitis.

CASE V.—Miss A. B., twenty-four years of age, was admitted to the German Hospital August 29, 1905. She had been ill for five days. The attack began with pain in the right iliac fossa, becoming general. Vomiting began on the third day of the attack. The bowels moved freely.

On admission, her abdomen was moderately distended and rigid. There was dulness on each side below the umbilicus. The flanks were tympanitic and very tender, the greatest tenderness being over McBurney's point. The leucocyte count was 24,000.

The patient was operated upon on the day of admission. On opening the peritoneum, about 750 c.c. of yellowish-gray pus escaped. The intestines were injected, and in places covered with plastic exudate. The appendix was perforated one centimeter from its base. Through this perforation a fecal concretion, pus, and fecal matter had escaped. The pelvis was full of pus.

The pelvis was drained with a glass tube and gauze, four pieces being used. The following day, the woman's temperature was 99.4°; pulse, 116; abdomen, soft. The bowels were moved in forty-eight hours, and gas passed freely. The patient was discharged one month after the operation, with a granulating wound of the abdomen.

CASE VI.—Llewellyn B., sixteen years of age, was admitted to the Germantown Hospital January 18, 1906, complaining of pain in the right iliac region. The attack had come on twelve days before, with some pain and vomiting. The patient felt better after this, but was not entirely well; although he went to school regularly. Tuesday night, two days before admission, he had a second attack of pain and vomiting. A nearby physician made a diagnosis of indigestion and gave some peppermint preparation. The next day the patient went to school.

The same day, the regular family physician was called, and found the boy suffering but little. The abdomen was soft; the temperature was but slightly elevated; and there was some pain in the appendiceal region. The diagnosis of probable appendicitis was made. Salts were given in repeated doses; and the parents were instructed to notify the physician at once, if the patient showed any symptoms of getting worse. At ten o'clock the patient vomited; but he slept the greater part of the night, according to the statement of his father, who did not consider him very sick. He tossed about some, but this was thought to be due to the salts.

Early on Thursday, the family physician saw the patient again, and a diagnosis of appendicitis was made.

The boy was admitted to the Germantown Hospital the same day. On admission, he complained of pain in the right iliac region, but he could not definitely put his hand upon the spot. The rectus was rigid; tongue, slightly coated; mental condition, dull. He was slow to answer questions, and was apparently somewhat excited by the examination. He did not know about his bowel-movements lately, but told about his attending school.

Immediate operation was advised. A lateral incision was made through the right semilunar line. Pus oozed from the wound. The area was thoroughly packed in every direction with large gauze sponges. The omentum was tied down in the

region of the appendix; the lowered end was thickened, and a dark mass of it was found surrounding the appendix. This was tied off and amputated. The appendix on being lifted up, was found to be perforated and dark. Out of the perforation rolled a large concretion. The appendix was ligated and removed; and the stump was inverted and closed over with Lembert sutures. Removal of the gauze pads showed creamy pus in every direction. A glass tube, packed around with iodoform-gauze, was placed in the pelvis. A rubber tube was inserted through a lumbar incision to drain the region of the stump. Three pieces of iodoform-gauze were placed to drain the abdomen; and a fourth piece was used as a cofferdam. Morphin sulphate was given before the patient came out of the ether.

The patient was discharged February 17, with a strip of gauze in the lumbar wound. The fascia was brought together with sutures two weeks before discharge.

CASE VII.—Robert A., twenty-six years of age, was admitted to the Germantown Hospital October 16, 1905, service of Dr. O. D. Whiting, complaining of pain in the lower abdomen, which was tense, rigid, and tender to palpation. Rectal examination showed a fluctuating mass in the right side of the pelvis.

The patient was etherized. A small incision was made through the right rectus. In the right side of the pelvis was an immense abscess, containing a large quantity of greenish-yellow, foul-smelling pus. This was allowed to run out; and the cavity was then sponged and irrigated with normal salt-solution. The appendix was not removed. A glass drainage-tube was inserted into the pelvis. Iodoform drains were placed at the side of the tube, running into the pus-cavity. The patient recovered from the attack, and was sent home.

He was readmitted March 6, 1906, service of author, for appendiceal abscess with intestinal obstruction; pulse 104, respirations 28, and temperature 99.6°. There was severe aching pain in the lower abdomen, which had lasted three or four days, during which time the patient had had no bowel-movements, notwithstanding that purgatives in heroic doses had been given him. The pulse, temperature, and respiration remained normal until after the operation. The abdomen was distended, and had a saggy, doughy feel. There was very slight tenderness in the lower abdomen. The patient had vomited several times,

but there was no fecal vomiting. The general condition, with the history, was strikingly suggestive of obstruction of the bowel; and the patient was operated on, March 7, for that condition.

An incision was made, cutting out the scar of the previous operation. Numerous adhesions, binding the bowel down, were found. These were broken loose, and in doing so an abscess was found in the right pelvis. This was opened and drained, pus flowing freely. The general peritoneal cavity was involved in the infectious process, giving rise to the obstructive symptoms. Four strips of iodoform-gauze were left in as drains, and pushed up toward the liver and spleen; and others, into the right and left pelvis, respectively. A glass drainage-tube was pushed to the bottom of the pelvis. The patient made a satisfactory recovery, after a prolonged convalescence.

CASE VIII.—M. W. was admitted to the Germantown Hospital on February 12, 1906, evidently in the second week of typhoid fever. His previous history is of no importance. Twelve days after admission he complained of a sudden severe, cutting pain in the abdomen, in the region of the appendix. The right rectus was rigid, there was tenderness, and the patient was sweating profusely. The pulse jumped from 78 to 104; the respirations, from 24 to 34. The temperature dropped from 101° to 99.6°.

Operation was performed seven hours after perforation had occurred. The perforation was six inches from the cæcal junction, completely sealed off by omental graft. There was diffused peritonitis. A glass tube and gauze drainage were inserted. The tube was removed in five days, and was replaced by a rubber tube. Fecal fistula occurred on the seventh day. Diarrhœa was the only bad symptom. Death occurred on the 26th, and was preceded by abdominal pain and tenderness, but no vomiting. The temperature rose to 108°; the pulse was uncountable. Perforation took place through the original opening, which had been closed by omental graft. The gut around the opening was gangrenous, as was the gut in touch with the area of the drainage-tube. The peritoneum of the pelvic walls and the parietal peritoneum were gangrenous. General peritonitis was present, and death took place fourteen days after the operation.

DR. ROSS, remarking upon these cases, said that it is evident that general purulent peritonitis is not necessarily fatal. Murphy

claims thirty-three cases of perforative peritonitis with one death. The statistics of other operators show various rates, from 50 per cent. to 70 per cent. of recoveries. In this short series, two out of seven cases due to appendicitis died—a death-rate of about 30 per cent.

The outcome of a case of general purulent peritonitis depends on the character of the infection, the quantity of the infection, and the area involved, rather than on the treatment instituted; although this treatment is a necessary adjunct to recovery in the majority of cases.

Operation should be performed early, and should be minimized to essentials,—*i.e.*, the abdomen should be opened rapidly, the focus of infection at once located and removed, the cavity of the pelvis and the area of original infection thoroughly and rapidly drained, and the wound dressed. The average time for these maneuvers should not exceed ten minutes. Time and the amount of anæsthetic are of great importance. These cases do not stand prolonged anæsthesia and handling of the viscera.

There are some cases in which irrigation is indicated—the cases of late operation, when the pus is thick and creamy. When irrigation is used, it should be thorough. His method was to place one hand in the cavity of the peritoneum, and have an assistant pour salt-solution from a pitcher as fast as it will run into the incision. The hand in the cavity is constantly working and agitating gently the abdominal viscera. This requires an extra five minutes, but is justifiable in these circumstances.

Fowler's position; rectal transfusion, continuous or periodical; and morphin, are important adjuncts to the treatment after operation.

The class of appendix cases most to be dreaded are those in which the organ occupies a retrocæcal position, toward the outer side and behind the cæcum, with the tip of the organ in proximity to the liver. These are the cases that die of sepsis. They develop symptoms early; the symptoms of general infection are severe, rapid, and out of all proportion to the local signs; the organ is so deeply placed that the signs are obscured; and drainage and removal of the appendix does not seem to reach the avenue by which the infection is traveling toward the liver. Even drainage of the retroperitoneal space does not prove satisfactory in all cases.

DR. FRANCIS T. STEWART, although he agreed with Murphy, Le Conte, and others regarding the principles of the so-called Murphy treatment of general peritonitis, in his own experience results before its adoption were just as good as those since it has been employed. Such results may, however, be accidental and not to be attributed entirely to treatment.

DR. ROBERT G. LE CONTE differed with Dr. Stewart as to the value of the Murphy treatment. He (Le Conte) has had a small series of cases of general peritonitis and has obtained a vastly better percentage of recoveries since adopting the Murphy treatment, the increase being 50 per cent. or greater. In the previous cases he did not employ any one method. Sometimes he irrigated, sometimes he sponged, and consequently the treatment varied. Formerly his mortality at the Pennsylvania Hospital was 70 to 80 per cent. His results now are not so good as those of Murphy but they are at least twice as good as they were previously. Whether or not this showing is accidental he cannot say. He is not prepared to state positively, but he believes the results are due to the treatment. The rationale of the method appeals to him very strongly, and he regards Murphy's method as the ideal way to treat cases of diffuse septic peritonitis.

DR. ROSS agreed with Dr. Le Conte as to the value of the Murphy treatment; it is founded on good surgical principles. It is true that of his seven cases he irrigated two and both recovered, but in them the character of the pus was different. It was thick and creamy, like that found in ulcers. Such cases are not to be feared as are those with thin, blood-streaked pus. The character of the infection is consequently of great importance in cases of peritonitis. In a class of cases mentioned, namely those with the appendix posteriorly and high up, the circulation carries the infection through the liver and the mortality is very high; no method of treatment can save most of these cases. When Dr. Ross is operating and sees free pus he at once puts in ten or twelve gauze pads around the site. These absorb pus while he is removing the appendix and thus save time by withdrawing the pus when later they are taken out.

CONGENITAL FISTULA IN TONGUE.

DR. GEORGE G. ROSS exhibited a man who since birth has had a fistula two inches deep in the median line of the tongue.

From this can be pressed pus-like material containing no epithelial cells nor special bacteria. The cavity holds two drachms of pus. It has been suggested by Dr. Jopson that the condition is one of lingual fistula due to the congenital presence of thyroid tissue at the base of the tongue.

DR. ROBERT G. LE CONTE thought the condition to be one of congenital thyroglossal duct and that misplaced thyroid tissue may be at the end of the sinus. His procedure would be to inject the fistula with colored fluid and then dissect toward it from the submental region until the sinus is reached. This can be followed to its base and the entire affected area removed. Within the past six weeks Dr. Le Conte has seen at the Pennsylvania Hospital a case of different origin but of somewhat similar character. It was a case of complete, branchial fistula. The external opening was at the anterior border of the right sternocleidomastoid muscle and the internal at the posterior part of the right tonsil. The case was treated by injecting the sinus with methyl blue through the skin opening, which was about the size of a hypodermic needle. The sinus was dissected out parallel to the sternomastoid muscle and the duct ligated one-fourth inch from the mucous membrane of the pharynx. Two weeks after the operation the patient was again seen; the wound had healed, and there was no sign of a return of the condition. Dr. McCoy examined the throat of the patient before the operation to see if the internal opening could be detected; the mirror failed to reveal it. That the fistula was complete, however, was shown by the fact that material passed through it when the child swallowed.

NORMAL PYLORUS SEVEN YEARS AFTER A SIMPLE PYLOROPLASTY FOR STRICTURE.

DR. JOHN B. ROBERTS reported the case of a man fifty-five years of age who was admitted to the Polyclinic Hospital on February 27, 1899, complaining of gastric symptoms for fifteen or eighteen years. He had pain after eating, which continued until the stomach was emptied by vomiting. He was weak, emaciated and anæmic. Investigation of the stomach by lavage and other clinical methods caused a diagnosis of stricture of the pylorus with gastric dilatation to be made. On April 4, 1899, Dr. Roberts did an ordinary pyloroplasty by making a horizontal incision through the pylorus and uniting the wound in a vertical

direction. There was no tumor of the pylorus and the condition was considered to be a fibrous contraction. The patient immediately had relief from the pain and vomiting and gained greatly in weight. He was discharged cured about six weeks after operation.

During the next six years he consulted the reporter on two occasions complaining of some gastric distress, which was attributed to a recurrence of the contraction, and it was suggested that he return for investigation, treatment and probable repetition of the operation. After each of these conferences, he, however, disappeared from view. He was a man of limited intelligence.

In April, 1906, he entered the Polyclinic Hospital for the relief of dysuria, under the care of Dr. F. T. Stewart. At the Hospital he complained of no gastric trouble and was able to eat and digest even meat. Dr. Stewart found a mass in the pelvis, which interfered with the voiding of urine, and made an exploratory abdominal incision on May 18. He found a mass, probably carcinomatous, involving the rectum, sigmoid colon and bladder, which was inoperable. The patient died two days later unexpectedly, probably from uræmia.

At the autopsy there were found a few old adhesions between the old celiotomy wound and the anterior wall of the stomach. The adhesions were in some parts quite dense, though most of them were easily broken up. The pylorus, according to Dr. John M. Swan, the pathologist, showed no sign of the former operation, except that the pyloric ring was not as distinct as usual. There was no thickening in this region and the pylorus admitted several fingers. There was some evidence of chronic gastritis with moderate dilatation. The specimen was not preserved for presentation with this report.

Dr. Roberts said that he presented this report to the Academy because it seemed to him to be interesting to have an opportunity to examine a simple pyloroplasty seven years after operation and to find that the mechanical effect of the operation continued to be all that was desired. There has been some discussion as to the value of this procedure, but, in the case under consideration, it certainly was the means of saving the patient's life. It is possible that the condition, for which the operation was done, was a spasm of the pylorus rather than a fibrous con-

striction. The latter condition was the lesion however which he believed to be present at the time he examined the pylorus and operated upon it.

DR. CHARLES F. NASSAU gave the detail of a similar operation he performed five years ago. The patient was a woman who suffered from constant vomiting until she had become markedly emaciated. She was in the Presbyterian Hospital for six weeks, where she was seen by Dr. Hughes. She grew progressively worse, the vomiting being uncontrollable by any method of treatment, and rectal feeding became necessary. No mass was felt in the abdomen and repeated stomach examinations were practically negative. Finally Dr. Hughes thought he felt nodular thickening along the right ureter, though there were no symptoms referable to the kidney. Exploratory laparotomy was performed and no explanation for the condition of the patient was at first found. A peculiar condition of the small intestine was that every three or four inches were fecal balls. These were not scybalous, being easily indented, and between them the intestine was collapsed, giving it a bead-like appearance. The little finger could not be passed through the pylorus and the operation as described by Dr. Roberts was performed. After a stormy convalescence the patient improved very greatly, gaining twenty-five pounds in a relatively short time. Her present condition is good. At certain times if she hurries after a meal she vomits, but she is in very good health for a nervous woman. In the absence of over-exertion the stomach functionates satisfactorily. It is difficult to say what the real condition in this case was, but relief by operation was fully demonstrated. This operation gives a mortality far lower than that of gastro-enterostomy, particularly when there is no dilatation of the stomach to justify the latter procedure.

PERITONEAL EFFUSIONS RESEMBLING BILE IN COLOR.

DR. GWYLYM G. DAVIS said that four cases had recently come under his notice bearing on the question of the origin and character of wound and peritoneal effusions resembling bile in color.

The first case occurred in a man about twenty-eight years of age while under treatment for gonorrhœal arthritis of the knee in a chronic stage. He was suddenly seized with severe pain

in the abdomen about twenty-four hours before Dr. Davis saw him. It became rapidly worse and when seen by the reporter his abdomen was distended, evident peritonitis, slightly more tender at McBurney's point than elsewhere, but with no mass or dullness to indicate that the trouble was mainly at that point. Through a transverse incision over the appendix it was found to be somewhat hardened and injected, but not gangrenous nor perforated and apparently not sufficiently diseased to be the cause of such a widespread peritonitis. There was a large amount of dark, grumous peritoneal fluid and only a slight amount of lymph, but the sponges used (gauze) were stained by the fluid a golden yellow color. Thinking this color might be due to bile, after removing the appendix, the wound was closed and another made over the gall-bladder along the edge of the ribs. The gall-bladder was found bathed in the same dark effusion but healthy. The incision was then prolonged toward the median line and the anterior wall of the stomach examined, with a negative result. An opening was then made through the gastrocolic omentum and the posterior wall of the stomach and pancreas, with the cavity of the lesser omentum, were explored, but nothing was found. The wounds were closed and the patient made a perfect recovery and was soon as well as ever.

The second case was in a young boy with a compound separation of the lower epiphysis of the femur. Several days after the injury the white gauze dressings showed the same golden yellow color as in the first case. He progressed favorably.

The third case was in a man about fifty years old who was brought to the hospital almost *in extremis* with diffuse general peritonitis. An examination showed an injected appendix otherwise apparently healthy. Purulent lymph through the intestines and a large amount of grumous, dark, peritoneal effusion staining the gauze sponges golden yellow. A hasty examination of the gall-bladder showed it to contain bile and it had a patch of purulent lymph on it. It was not at all thickened by inflammatory action but entirely normal in consistency. The stomach was normal. Both wounds were drained but the man died some hours later.

The questions arise as to what causes the peritonitis and why was the effusion golden yellow in color? In the first case

the appendix was almost certainly the cause of the disease, as its removal and cleansing of the abdomen cured him. In the third case either the appendix or gall-bladder could be possible causes but neither was perforated; and it seemed more likely that here again the appendix was the primary focus. The pancreas was not the source in either case. Both cases lead one to think that the most virulent types of peritonitis can be produced by a diseased appendix with no adhesions, no perforation, and only showing a slight injection.

As regards the peculiar color of the effusion it was due to disorganization of the coloring matter of the blood. That it was not due to bile in the first case was shown by its absence being demonstrated by a chemical examination of the effusion. In the second case, as it was one of compound separation of the epiphysis of the femur, it was evident that bile could have had nothing to do with it. In the third case the gall-bladder was found to contain bile which did not exude through any perforation of its walls when subjected to pressure, hence it was probably not the source of the bile-colored effusion.

These facts should teach us to be chary about attributing to effusions which stain gauze sponges a golden yellow color a biliary origin.

In a case recently of rupture of the liver, as soon as the abdomen was opened black liquid and clotted blood poured out; when this was rapidly cleansed away the intestines were seen stained over a large area a dirty yellowish-brown color. They were positively stained and not, as in the former cases, of a red color and bathed in a dirty liquid.

On examining the liver a deep rent was seen to the right of the gall-bladder, extending completely through its substance from the transverse fissure on its lower surface up through the free edge to the coronary ligament on top. This man died four days later, possibly of biliary toxæmia but not of hæmorrhage or peritonitis.

THE WEAKENING EFFECT OF A LONGITUDINAL INCISION THROUGH THE RECTUS MUSCLE.

DR. GWILYM G. DAVIS reported the case of a man about forty-six years of age, who had been operated on for appendicitis about a year previously. It was a suppurative case, with drain-

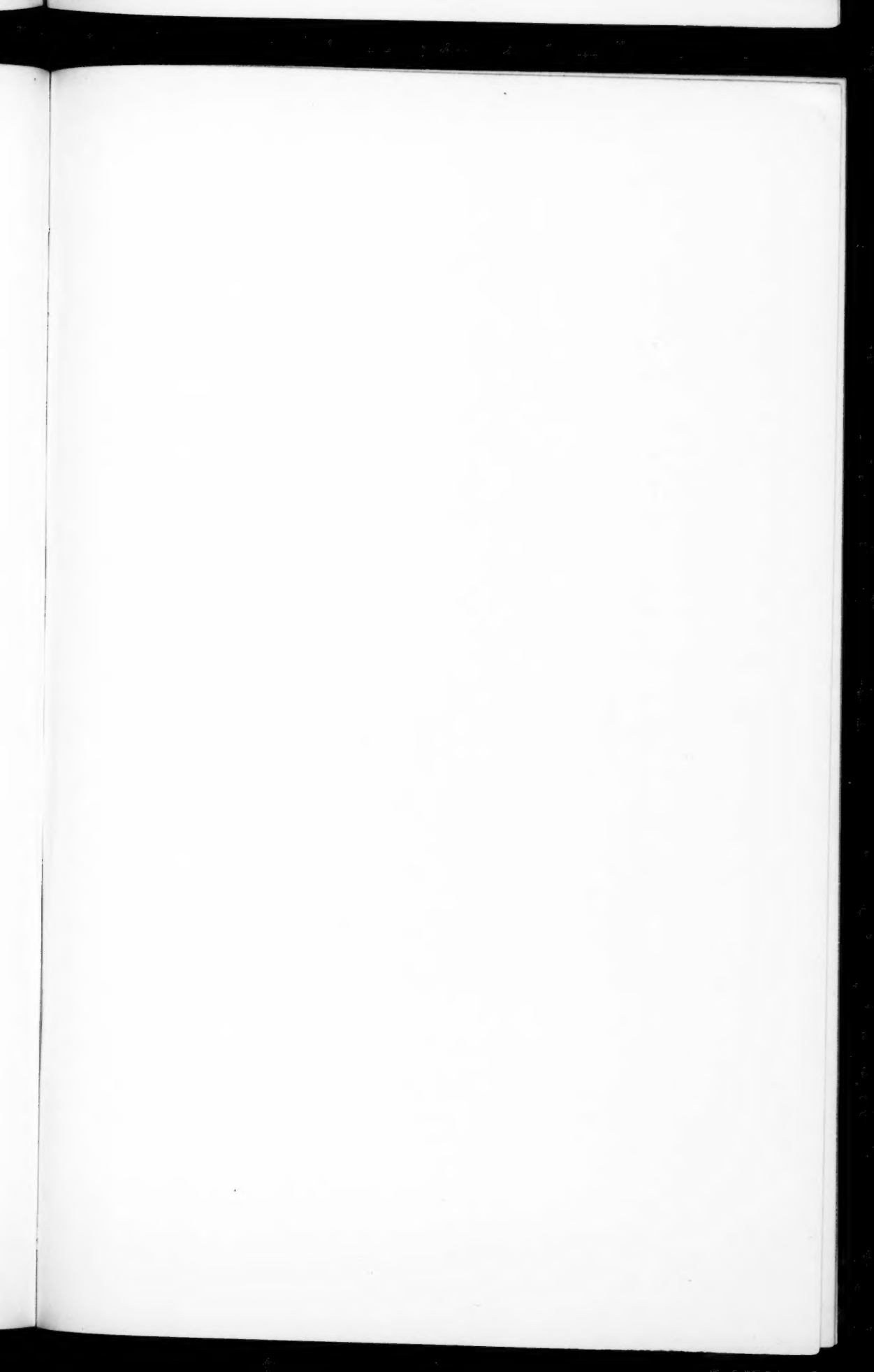




FIG. 1.

age, and the incision was made through the right rectus muscle about an inch from its outer border. It extended from an inch and a-half above the umbilicus to three inches below. He was a stout man and wore an abdominal belt. After recovery the rectus muscle in the region of the wound began to protrude and particularly when the belt was off gave him considerable discomfort. He applied for treatment because during the past two months the protrusion had markedly increased.

On examination the scar was found firm in its full extent; there was no parting of the muscle with hernial protrusion through the line of incision. There was no ventral hernia but the whole rectus muscle opposite the level of the incision bulged forward. The line of the incision can be distinctly seen in the photograph (Fig. 1), not as a protrusion but as a depression with the bulging of the paralyzed muscle alongside. In this case it is probable the tenth, eleventh, and twelfth thoracic nerves were divided. The patient was treated by widely excising the scar and sewing the anterior and posterior layers of the sheath of the rectus and the muscular fibres together in separate layers.

In the January 1906 issue of the *ANNALS OF SURGERY* he had published a paper in which he had advocated a transverse incision for the operation of appendicitis and gave as one reason the avoidance of injuring the nerve supply to the rectus muscle. This case is illustrative of that point. The popularity of the incision through the rectus can only be accounted for by the belief that the amount of paralysis of the rectus which is produced is unimportant.

That this is so, at least to a considerable extent, when the incision is quite small, may be admitted, but frequently what are expected to be easy cases prove to be more difficult. The desirability of additional room causes the incision to be enlarged and also sometimes pus necessitates drainage and then the incision is not so innocuous and conditions such as shown in this case occur as sequelæ.

DR. CHARLES F. NASSAU said he had a great deal of interest in the subject of abdominal incisions as during the past eight years he had studied the effects of many rectus incisions in his gynecological work at the German Hospital. He has become convinced that a large percentage of abdominal cases are followed

by paralysis of the abdominal wall or by hernia. We say that if wounds heal by first intention there will be few hernias, and this has been well shown by Maurice Richardson. But while it is true that primary suppuration of a wound exercises a great influence on the subsequent occurrence of hernia, at the same time we often see hernias when the appearance of the scar indicates that union by first intention had occurred. The appearance of the scar may be misleading, but when this is reinforced by questioning the patient as to the length of time in bed and the number of times the wound was dressed, the conclusion must be reached that hernia occurs even in wounds that heal by first intention. Unquestionably these cases are due to paralysis of the inner side of the rectus muscle which has been deprived of its nerve supply. Analogous cases are those known as crutch paralysis, wrist drop, etc., which follow interference with nerves, and prove that paralysis may be due to such injury. If the nerve supplying a muscle be cut, the muscle becomes valueless and gradually gives way with resultant hernia. All surgeons who have performed kidney operations necessitating extensive incisions have noted that afterward the entire side of the abdominal wall hangs pendulous. When Dr. Nassau makes a median incision he cuts the sheath of the rectus muscle and then pulls the muscle from the median line and avoids cutting it if possible. He began using the method advised by Dr. Davis before his paper appeared and has become convinced that if one employs this method or a modified McBurney, going toward the median line and downward when it is necessary to get into the pelvis, that paralysis will not follow. He operated on a patient last fall and through the incision determined there was no tubal or ovarian disease and also that there was no distention of the gall-bladder and there has been absolutely no paralysis since. When surgeons used the incision known as Sonnenburg's they recognized that the farther out it was made the less danger there was of hernia. This was due to the fact that in the latter instances none of the nerves supplying the internal oblique were cut. One can make the wound by the Davis method large enough to allow of any reasonable manipulation and yet by suturing layer to layer secure a firm wall if there be healing by first intention. If such incision be used in bad cases of appendicitis, not of the desperate type but those in which there is a question of drainage,

the wound may be completely closed after a small wick is placed under and passed out posteriorly in the loin. Surgeons will find this incision more satisfactory the oftener it is employed. A second incision is of course necessary when the gall-bladder is diseased. An advantage of the Davis incision is that one can go down to the rectus muscle, pull it to the inside, and thus secure a great deal of room. Then if it be necessary to go into the pelvis the incision can be prolonged along the rectus because this will be below the nerves. On account of the frequency with which this is necessary in women, Bloodgood often starts with a U-shaped or boomerang-shaped incision in the skin. One of course should not employ the incision if suspicious of pelvic disease in women, but in men it serves every possible purpose.

DR. ROBERT G. LE CONTE said he did not like to disagree with the proposition of Dr. Davis, but that he had performed hundreds of operations through the right rectus muscle, with and without drainage, and with perhaps two exceptions he has no knowledge of subsequent hernia. It is true that the patients at the Pennsylvania Hospital belong to a nomadic class and the statement does not mean that hernia has not occurred more frequently but that he has no knowledge of it. He incises the fascia fully and then tears the muscle fibres apart with his fingers. In tearing through the muscle the nerves are usually stretched but not lacerated. If the incision is more than three inches in length one or two nerves may be seen as white flaccid cords, traversing the incision. He frequently separates the muscle bundles above or below these little threads in the wound. There is no paralysis of the rectus from this incision. He is of the opinion that the incision recommended by Dr. Davis does not give much more room than does the McBurney incision unless muscle fibres are cut across.

ACUTE HÆMORRHAGIC PANCREATITIS.

DR. FRANCIS T. STEWART reported two cases of acute hæmorrhagic pancreatitis. For the privilege of operating upon and reporting Case I he was indebted to Dr. Robert G. Le Conte, and for Case II to Dr. T. G. Morton.

CASE I.—J. H., female, aged forty-eight was admitted to the Pennsylvania Hospital May, 1, 1906. About sixteen years

ago she had an attack of jaundice, which left as a legacy a severe indigestion characterized by more or less continuous epigastric pain, worse after eating, and attacks of vomiting. There has never been any blood in the vomitus or in the feces. The patient has lost considerable weight and has become a morphin habitué. During the past few years she has also had several attacks of "kidney trouble", *i. e.*, the lower extremities would become oedematous and the urine dark and reddish. Two days before admission the pain became agonizing and the vomiting continuous.

On admission the temperature was 99 F., pulse 92, the respiration 36, and the expression anxious. There was excruciating pain in the epigastrium reflected to the back and to the left shoulder. The whole epigastrium was tender and the muscles moderately rigid. Beneath the muscles could be felt a mass stretching across the epigastrium. An incision through the right rectus muscle revealed scattered areas of fat necrosis on the great omentum and one spot on the jejunum. The pancreas was exposed by tearing through the gastrocolic omentum; it was twice the normal size, indurated, infiltrated with blood, and covered with areas of fat necrosis, one of which was excised and proven to be necrotic fat on microscopic examination.

There was no free blood in the lesser peritoneal cavity. A horizontal incision about four inches long and about one-quarter of an inch in depth was made into the pancreas and packed with gauze for the purpose of drainage; there was very little bleeding from this incision. The gall-bladder, which was tensely distended with dark bile, was drained, it being fastened in the upper angle of the wound. No stones could be found. Cultures from the pancreas and gall-bladder made at the time of operation were sterile. No pathological lesion could be detected in the stomach. Urine yellowish red, cloudy, whitish sediment, acid, S. G. 1022, considerable amount of albumin, no sugar, many hyaline and rather coarsely granular casts and leucocytes, and a few epithelial cells. Hewitt's test for lipose negative. Several subsequent urinary examinations were made with practically identical results.

Subsequent to operation the pain was markedly relieved but did not wholly disappear for three weeks. The gall-bladder fistula closed in three weeks, but there is still a small sinus at

the lower angle of the wound marking the site of the pancreatic drain; pus from this sinus shows the ordinary pyogenic bacteria but no necrotic fat.

Case II.—C. W. female, aged fifty years, was admitted to the Pennsylvania Hospital November 25, 1899. She had never been ill before. The present illness began three days ago with sudden sharp pain in the epigastrium and vomiting. Previous to this the bowels moved regularly each day but since there has been absolute constipation. Purgatives and enemata were given each day without result. On the second day of illness the pain shifted from the epigastrium to the left iliac fossa and the vomitus became black and foul-smelling. On admission the temperature was 99 F., pulse 120, and weak, and the respiration 36. The countenance was pinched and covered with perspiration, the tongue red with a white strip down each side, and the breath fecal. The abdomen was distended and most tender in the left iliac fossa. Vaginal and rectal examinations were negative. Diagnosis, intestinal obstruction, Immediate operation, Median incision below the umbilicus revealed disseminated fat necrosis.

The patient's condition at this time was so serious that the wound was hurriedly sutured. Death at the completion of operation.

Postmortem made through the abdominal wound by Dr. J. A. Scott. Omentum speckled with round, yellowish white, slightly raised areas varying in diameter from one eighth to one-fourth of an inch. The mesentery but not the intestine showed the same spots seemingly following the blood-vessels. On microscopic examination these areas are found to be composed of fat droplets, granular material and many crystals. The pancreas is covered by a bloody plastic exudate, is indurated and about three times its normal size. The peripancreatic fat is necrotic in numerous places. The pancreas itself is deep red in color and shows numerous necrotic areas; it is infiltrated with blood, the hæmorrhages being most marked in the body and tail.

Urinary examination revealed albumin and casts, but no sugar.

DR. STEWART stated that one point was worthy of discussion. The general advice in textbooks is to open and drain, but they do not say whether the pancreas should be punctured or incised,

or if the lesser peritoneal cavity alone should be drained. Laboratory workers say to avoid incising the pancreas because the secretion exerts an untoward effect upon adhesions, the surrounding fat, and even upon other tissues. In the case reported he incised the pancreas. Is this the proper procedure? It did no harm in this instance, at least.

He recalled a case of gunshot injury of the pancreas, the bullet going also through both walls of the stomach. It occurred soon after Park advised posterior drainage in such cases, but the wound was so clean and the peritoneum in such good condition that he did not drain, even after reading Mikulicz's statements on the subject. The patient recovered, hence leakage could not have been great. Park, Körte, and others advise posterior incision below the lower pole of the left kidney for drainage after the first incision has been made in front, the latter being usually done in order to make the diagnosis. In some instances they close the anterior wound after draining posteriorly. In his case he drained anteriorly.

SURGICAL PROGRESS.¹

GENERAL SURGERY, PATHOLOGY AND THERAPY

I. Experimental Research into the Primary Bacterial Contents of Operative Wounds, with a Proposal as to their Protection. DÖDERLEIN (of Tübingen) reported on the primary flora of the abdominal cavity and incision in one hundred coeliotomies and in similar previous work.

His tests showed that in spite of the most vigorous protection afforded by modern aseptic technique, consisting of rubber gloves and cuffs, masks, Küstner's rubber-covering of the abdomen, etc., the abdominal cavity as well as the incision invariably contained bacteria. This agrees with his previous investigations as well as with those of others in which a germ free-field was unattainable. Döderlein is also in accord with other authors in considering the skin of the operative field the last and most important source of the infection. To exclude this source it does not suffice to disinfect the skin, which is as unattainable as the complete disinfection of the hands, especially difficult to reach being the germs in the deeper layers of the skin. He suggests the course to be pursued in which the aim is to hinder the delivery of germs from the skin to the wound. After the patient is prepared by bathing, lathering and shaving, the skin of the entire neighborhood is forcibly rubbed with formalin-benzine or iodine-benzine and then painted with pure tincture of iodine. The object is to render the skin during the operation as sear as possible. Over this iodine paint, is placed with the utmost care a sterile solution of rubber so that it adheres tightly. (This solution under the

¹ Excerpts from the TRANSACTIONS OF THE GERMAN CONGRESS OF SURGERY, held in April, 1906. Translated from the abstracts published in the Beilage zum Zentralblatt für Chirurgie, No. 28, 1906, by J. C. REEVE, Jr., M.D., of Dayton, Ohio.

name "Gaudanin" and an instrument suitable for its application is to be had from Tieger and Wigand, Leipzig.) After the rubber membrane is dry it is sprinkled with sterile talcum to cover its stickiness, and it is now a thin, smooth, shining, sterile membrane, cleaving to the skin, and which can be, after the operation, easily removed by benzine. Many cultures controlled the results with and without this rubber protective, and showed that with it Lister's ideal of a germ-free operation could be attained.

VON BRUNS (Tübingen) said that in sixty successive cases, where the usual skin disinfection was done, all contained staphylococcus albus. The imprisonment of these skin bacteria is urgently needed and is accomplished in an ideal manner by this rubber covering. It sticks remarkably and is durable in spite of its thinness. With it it is possible to keep an aseptic field in a region rich in bacteria. In his clinic the stock solution of rubber coming from the factory is diluted with iodine-benzine to an iodine percentage of 2, and before applying the rubber a disinfection is done by applying a one per cent. solution of iodine-benzine.

HEUSNER (Barmen) rejects entirely the washing of the skin and instead paints it with a one percent. iodine-benzine solution to which is added a little paraffin oil (liquid vaseline) by which means the germs are fixed.

VON OETTINGEN advises, especially in war, surrounding the wound with a solution of mastic 20 grams, chloroform 50 grams and linseed oil 20 drops, and affixing to this sterile cotton.

II. The Secretion of Bacteria by the Sweat-Glands.

WEDE (Königsberg) concludes that up to the present time there has been no clear proof that bacteria have been secreted by the sweat-glands from the blood current.

III. A New Hemolytic Reaction of the Blood-Serum in Cancer Patients and its Diagnostic and Statistical Employment in Surgery.

KELLING (Dresden) claims that the blood

corpuscles of certain vertebrates, especially of chickens, less frequently of swine and sheep, are more quickly and strongly dissolved by the blood of cancer patients than by the blood of other patients or of well persons, and also than are the corpuscles of other vertebrates. This reaction is parallel to the precipitin reaction; with it under certain experimental conditions tumors that are not palpable may be diagnosed; the specific solubility is constant with one and the same cancer. As the primary tumor so is the reaction of the metastasis. Extirpation of the tumor abolishes the reaction. The reaction is independent of the cell-form. The reaction is to be obtained by injection of the tumor tissues into the animal body. Tumors are to be divided into two groups—those to which vertebrate corpuscles react and whose cause is to be traced to embryonic vertebrate cells, and those to which vertebrate corpuscles do not react and whose cause is to be sought in the cells of vertebrates.

IV. Bier's Constriction-Hyperæmia for Acute Inflammation. HABS (Magdeburg).—Contraindications are, first, erysipelas. In four cases the erysipelas spread beyond the tourniquet; indeed it became worse. Second, presence of venous thrombosis (embolus of lung in one case). Third, diabetes. Arteriosclerosis is no contraindication. In four cases of wounds was it applied where surgical aid had been neglected or had made them worse, also where a foreign body was extracted. In all was suppuration prevented. It is not applicable in syphilis.

KÖRTE applied this method in spite of diabetes to a phlegmonous panaritium. The phlegmon retired and the finger healed.

CROCE finds the results not satisfactory in osteomyelitis. He recommends small incisions; also in beginning phlegmon which they do not harm. The application (through exhaust cups) to panaritium is too painful and does not give good results. But with subpectoral and axillary abscesses it is satisfactory. In perityphlitic abscess

the "sucking" does good if there is no communication with the bowel. Very good for stitch abscesses.

SICK has treated 250 cases by this method with generally favorable influence, especially so in severe phlegmons. He mentions the lessened pain, the quicker healing, the better functional result. It worked deleteriously in streptococcic phlegmons, causing acute gangrene of the skin, the same in diabetics, in varicose ulcers and thrombophlebitis. One patient died. In single cases of erysipelas the method was remarkable, but in one great swelling and pain led to the abandonment of the tourniquet, after which the erysipelas retired. Often erysipelas appeared with the constriction of suppurating wounds. In anthrax two cases were good. One could not stand the extreme œdema. In one case of osteomyelitis of the tibia shaft appeared suppuration of the knee-joint. A girl with severe angina and suppuration of the shoulder showed good results.

The method is suitable for hospital treatment only, as it must be watched.

STICH reported on two hundred and more carefully recorded cases of uniformly favorable courses. Particularly in acute tendo-synovitis and panaritium. In these constriction was combined with small incisions and the utmost avoidance of tamponade. An unfavorable course is to be ascribed to technical difficulties.

In acute osteomyelitis the method has often disappointed and he will here open the bone at once, on the ground of the following case: A typical osteomyelitis of the upper end of the humerus in which in the course of a week the entire diaphysis became necrotic. No disadvantages were noted in erysipelas, nor the formation of abscesses under the hyperemia in cases of general pyogenic infection. Particularly valuable seemed its use prophylactically in wounds after primary union but suspected of deeper infection.

DANIELSEN reported on 260 cases, and many more. It failed in 2 percent. Even if the signs of inflammation do not retire in a few days the constriction should be con-

tinued. Only when these pass beyond the line of constriction, and high temperature appears, should the old treatment be adopted. Danielsen has seen good function follow partial tendon necrosis.

BARDENHEUER acknowledged himself a convert. At first he had many failures and it was not till he had met an assistant of Bier's that he became proficient in technique and had good results. The method requires much attention and skill and must not be permitted to wander from the hand of one assistant to the other. He had had exceptional results in teno-synovitis, acute knee-, foot-, elbow-, shoulder-, and finger-joint disease, acute osteomyelitis and periostitis, phlegmonous bursitis, carbuncles. The functional results in the first were very good. Several of the osteomyelitis cases were severe and of the whole number a good percentage were healed without incision. In suppurative joint-disease, primary and secondary, complete function often followed. Once this followed suppuration of the leg, ankle and foot.

HEIDENHAIN.—Most important is the knowledge that the œdema will disappear in the interval between applications. Pus must always be evacuated. He opens the tendon-sheaths in the fold of the skin, thus hiding them and leaving them more pliable. Scars after this treatment are movable, and on this account he uses the treatment twice a day prophylactically in wounds of the fingers.

LEXER said that this treatment can be adopted without danger only in relatively light forms of inflammation; in severe it is a game of chance. Here more than with any other treatment depends the result upon the severity of the infection and the resistance of the tissues. In all light forms with little fever he had good results. The entire course however was not shorter, since one is forced to watch over the case in order to avoid sequelæ. In severe cases the results are various. Favorable courses stand opposed to unfavorable, local and general. An explanation for this Lexer sees in the heightened processes in the inflamed

area, which in serious infections is harmful to the tissues. In consequence of the locally-increased protective juices an increased bacteriolysis appears. Through this a great quantity of endotoxines become free and accumulate during the constriction, which, according to the length of the application and the grade of concentration harm the tissues and so prepare a ground for the tissue-dissolving ferments. Hence the cataplasm effect of the hyperæmia, the rapid and far-reaching melting of the infiltrate, the extensive undermining of the skin, the breaking of pus into sound tissue and the often protracted course through ever renewed infiltrate and abscess. . . . A general infection can appear through increased absorption after removal of the ligature. Indeed the entire effect which one ascribes to the tissues may depend on the small incision. But these work a minor rôle only, are small and applied late.

All the disadvantages which this method brings upon a much-inflamed tissue disappear when we deal with a wide-open wound or where pus collections have been widely opened before the constriction. Here there is a mechanical washing out of the infection by the transudate, and the old methods have at the same time full play. Lexer therefore recommends the method only as an adjunct to tamponade (drainage).

The suction treatment (by exhaust cups) works excellently and rapidly in light infiltrations or in furuncles where there is a necrotic core. In progressive inflammations without demarcation the course in spite of small incisions easily miscarries, dissolution is easily increased and extensions to deeper planes are often promoted. The infiltrate is more and harder than after incision without exhaust.

PERTHES already in 1898 published the value of "aspiration" (*i.e.*, exhaust). If a heavy dose of strychnia be injected in an animal, an incision made in the region and exhaust applied the animal does not die. The same experiment with incision but without exhaust leaves the animal with severe but non-fatal symptoms. With exhaust and

without incision severe symptoms remain in abeyance so long as the exhaust continues. When the exhaust ceases fatal cramps appear. So is shown the value of Bier's method, especially when combined with incisions. To attain a uniform exhaust Perthes uses a form of Bunsen aspirator in which the exhaust is regulated by the difference in level of two reservoirs of water.

CANON recommends gradual release of the ligature to avoid washing of bacteria into the blood-stream.

HOFMAN by means of a constrictor at the height of the navel had brought about a *dry* gangrene in a case of urinary phlegmon. If the constriction is too tight we get a lessening instead of an increase in the blood-pressure.

HELLER reported two cases of gangrenous erysipelas which healed rapidly. Once thrombosis of the arm veins occurred. He wished an exact formula with which to apply the method. In long suppuration, in lowering of the body strength, then away with constriction.

KÜSTER had seen rapid healing of a suppurating echinococcus of the kidney with evil odor.

THÖLE said that the Bier method was unscientific. It is to be condemned on teleologico-anthropomorphological grounds. Against it is also the theory of the vasomotor nerves, usually entirely neglected.

HAASLER, owing to lack of an autopsy, had failed to prove the relationship between an axillary abscess treated by constriction and a following fatal meningitis.

In order to exclude subjective impressions he compared fifty cases of this method with fifty treated by the old methods. The two series were as much alike in every particular as could be. With these (progressive forms of inflammation) he failed to find any superiority in the Bier treatment!

With well demarcated inflammation like furuncle it was different. Here, especially in mastitis, it possessed great advantages. Also in gonorrhœal arthritis.

STETTINER.—The employment of several little glasses (cups) would not replace one larger. . . . He often saved the last phalanx where it was formerly lost. In mastitis suckling was but briefly interrupted. Where there is much secretion from a wound where the drains have been early removed, suction does much good. The healing of old fistulas without curettage was made possible.

GEBELE had seen one fatal result from mastitis with many little abscesses leading to ablation.

KLAPP recommended providing the finger-cup with a cuff formed from a rubber finger-cot.

BIER supplied much material. The cases of osteomyelitis healing without necrosis were the lighter forms. In joint troubles he expected much. The severe traumatic suppurations were often followed by good functional results. About 60 percent. of ear suppuration was followed by good hearing; acupuncture only of the mastoid abscess. Only early cases are suitable for this treatment. No good results were noticed in erysipelas and in streptococcic infection.

Active motion was better than passive, especially that in the warm bath. The whole process is yet too little understood to give the *rationale*. Permanent constrictors he had not entirely abandoned, but they are to be avoided. Pain during constriction is not always a contraindication; it often depends on the technique. The general principles were that the hyperæmia did not cause pain but lessened it, did not cause necrosis but prevented it; that inflammation was finally a protective process.

V. The Treatment of Surgical Tuberculosis by the Exhaust Dry Cupping Method. KLAPP (Bonn) said that this is the best means of treatment, especially of the acute local inflammations. The length of the applications need not be closely adhered to. The forms tending to softening (to fistulas, etc.,) are best adapted to this treatment. The opening of cold abscesses is not justi-

fied if they have not been treated by exhaust. If opening occurs the expected secondary infection does not occur. Experiments show that open tuberculous tracts thus treated have very slight infection. He likens this treatment of synovial tuberculosis, combined with frequent puncture, to the favorable results obtained by the oculist in puncture of the anterior chamber in tubercular iritis.

VI. On the Prophylaxis and Treatment of Tetanus.—POCHHAMMER (Griefswald) said the serum treatment of tetanus is insufficient. After the appearance of the cramps the antitoxin is ineffective. More is to be expected from the prophylactic use of the antitoxin, which has much to recommend it on several grounds. He reports a failure where a reliable serum was injected fourteen hours after a severe machine wound of the foot. Healing satisfactory. On the fourteenth day signs of local spasms and drawing pains in the bone. Three weeks later pronounced general cramps; tetanus ascendens (which is confined almost exclusively to animals), protracted course and death from diaphragm involvement after the local spasm had passed. The injections had decidedly controlled the beginning and course of the disease but did not reach to the end of it. Pochhammer therefore advises a repetition after ten or fourteen days.

KÖRTE thought there was less tetanus now. He would hesitate before using antitoxin prophylactically.

DEUTSCHLÄNDER reported a stormy case of tetanus in spite of prompt injection. After free evacuation of fluid under high pressure by lumbar puncture in one hour the disease ceased.

HECKER.—Every severe wound is treated by injection, and we never see an ill effect.

RIEDINGER.—Territorial extent is important. He had made two amputations without rescue.

KÖRTE had cured a puerperal case of severest form by morphine and chloral. He never uses prophylactic injections and yet never sees tetanus.

KRÖNLEIN has injected intravenously as well as subcutaneously and is skeptical.

BRAUN has seen four cases in spite of prophylactic injection.

POCHHAMMER thought it to be safer to inject all wounds of the feet, especially those soiled with garden earth and wounds containing foreign bodies, especially gunshot wounds.

VII. On Laparotomy under Spinal Anæsthesia and Scopolamin Sleep. KRÖNIG said the first alone even in its best forms has been utilized very little in abdominal and gynæcological operations because the unpleasant effects are so serious. The unpleasant position of the patient, the tied arms and the commands of the operator make a distinct disturbance on the mind of the patient; too inhuman. With relatively small doses of scopolamin-morphine we may produce a condition in which the parturient perceives the pain but does not apperceive it; forgets it immediately. In ten weeks he applied this method, to the exclusion of all inhalation, to 65 cœliotomies, 28 vaginal cœliotomies and to 160 major gynæcological and obstetrical operations.

Technique.—About two hours before the operation inject 3 decimilligrams of scopolamin and 1 cg. morphine. Repeat in an hour. An hour later if the patient is not in lethargy, "twilight sleep," tested by her recollection, scopolamin in dose of $1\frac{1}{2}$ dmgs. is injected. Krönig does not use more than 9 dmgs. scopolamin nor 2 cg. morphine. If this is not sufficient nitrous oxide is used, and if this fails, chloroform-ether. The latter was never necessary when injections were also made into the spinal canal. To block all the senses black spectacles are used and double screens to the ears. Into the spinal canal stovain-bouillon was generally injected, .08 to .12 cg. stovain for laparotomies and .08 cg. for vaginal cœliotomies.

The patient sleeps deep and quiet through the operation. The chief advantage is in the after condition; 154 out of 160 had no nausea nor vomiting. Fluid is soon

given. Bronchitis has never been seen. After the most severe operation patients rise in two to six days. In three percent. severe headache.

VIII. Silver Wire as a Percutaneous Deep Suture.

E. KÜSTER (Marburg).—As a precaution against bursting open of the (abdominal) wound Küster uses through-and-through sutures of silver wire and then closes the wound in layers. Where there is infection and need of drainage the wire is placed to be closed later. In tuberculous peritonitis the suture must not reach quite to the peritoneum. He uses this also in hernias, wandering kidney, broken patella and long bones, and resections. The sutures are easily removed.

IX. General Lymphomatosis treated by Röntgen Rays. CLAIRMONT (Vienna) reported the history of a tumor, 5 cm. high, which extended over the back of the hand and forearm, situated in the skin. With it was general enlargement of the lymph-glands, of the liver and spleen, and small skin tumors on neck, back and both feet. Microscope proved it to be lymphatic in its origin. In a month the hand was subjected to the rays 30 times for 10–15 minutes each time. The tumor has almost disappeared and the patient returned to work. Less treatment to the other parts has caused distinct improvement. Whether lymphosarcoma or pseudoleukæmia is to be determined.

X. The Behavior of Bone Arteries in Disease and Fracture. DELKESHAMP (Königsberg).—The method used was to inject the vessels by an emulsion of mercury and turpentine, then take out the bone and take skiagraphs. In joint tuberculosis was a great overgrowth of the epiphyseal artery. In only one case was a tortuous dilatation of the nutria tibiæ, showing an increased friability. In a case which had osteomyelitis and sequestrum thirty years before the lower nutrient artery was completely lost and replaced by a rich net-work of periosteal arteries. A deformed elbow in syringomyelia showed a complex net-work of the epi-

physeal artery, anastomosing much with itself and with the nutria. In rickets there was the greatest vascularization at the epiphyseal line, the nutria showing a bunching toward the cartilage. In malignant tumors was a pronounced growth of abnormally coursing vessels. Those in the growth were so numerous that the mercury appeared in the skia-graph as an even plane. After removal, the abnormal periosteal vessels were then permitted to be seen. It is by these vessels apparently that the neoplasm extends itself so rapidly.

Fractures exercise an enormous stimulus on the nutria. It responds with the building of new branches which appear in the earliest days after fracture. At the completion of consolidation the vessels retire and become normal soon after six weeks. The multiplication of the intra-osseous and periosteal vessels goes hand in hand.

XI. On Cysts of the Long Bones. LEXER (Königsberg) presented a case which sheds new light on the nature of cysts of the long bones. A thickening of the shoulder appeared in a boy of fourteen, four years after a contusion. Diagnosis; central cystic enchondroma. It was found to be a single large cyst containing brown fluid and reaching from the cartilage to the middle third of the humerus. The walls, much honey-combed, consisting of very thin cortex and their smooth surface together with septum-like projections, betrayed the origin to be in a tumor. The entire portion of the bone was subperiosteally resected and replaced by a piece of fibula with periosteum, fresh from an amputation. The periosteum and then the skin were closed. Skiagraph shows the graft covered by a thick shell of bone. Function normal and shortening abolished. Microscopic examination shows, though no tumor tissue was found, the cyst came from the liquefaction of a previous enchondroma. This because numerous hyaline cartilage islands are in the walls.

XII. Osteodystrophia Juvenilis Cystica. TIETZE (Breslau) exhibited a preparation of a cyst of bone which

he believed sprang from an *ostitis fibrosum*. A girl of eighteen received a fall five years before and suffered from great pain in the thigh. She entered hospital on account of a fracture of the right femur. Bone cysts at the site of fracture and in the tibia. Operation. The two bones showed a very thin cortex distended by a fibrous mass which in places plainly showed a softening and transformation into cysts. In general it is built on the type of "osteoid tissue," and nowhere cartilage cells. Tietze claimed that in finding cartilage cells near a cyst we were not at all justified in claiming the origin to be *enchondroma*.

The discussion showed much diversity of opinion in regard to the cause of bone cysts.

XIII. Hematogenous Osteomyelitis from Actinomycosis. WREDE (Königsberg).—Actinomycosis of bone comes almost exclusively from extension into the bone from the neighboring tissues, very rarely from metastasis. Only three cases of the latter were found, and then from the lungs with many metastases in the soft parts, the latter overshadowing the bone lesion. He presented a preparation of a focus in the upper end of the femur which dominated the clinical picture; the primary lung focus could hardly be found. Many other metastases.

XIV. On Traumatic Osteoma. KÖNIG (Altona) spoke of the very rare tumors which follow a single trauma without fracture. About eight days after a heavy blow or kick pain appears and a steadily growing tumor. Skiagraph shows a growth first extending out from the bone and then turning upwards—tobacco-pipe form. Usually the growth throws a Röntgen shadow with clearer patches. In a few months growth ceases, or retires. Microscopic examination shows the growth between periosteum and the point of attachment of muscle to bone, partly fibrous and partly ossified. The process resembles periosteal callus and he proposes the name "fractureless callus-tumor."

This conception leads to conservative treatment;

operation only for unbearable discomforts. If forced to operate it should be done radically.

XV. Histology and Radiography of Tardy Forms of Hereditary Joint Syphilis. BOSSE (Berlin).—Most of our knowledge of this disease has come from the oculists, because it is often accompanied by interstitial keratitis. It cannot cause wonder that the cause has been overlooked when it is remembered that other disturbers of nutrition, tuberculosis, rheumatism, etc., may be a cause and that the dog, horse and bear may be subjects of it.

Naturally only the third grade of the disease is to be certainly detected by the radiograph, in which the widened zone of calcification through gummatous process is bulged in "necklace form" or is broken through altogether. The earlier forms were naturally not so distinct and may be confused with rickets. A thorough examination by skia-graphy should be made as to the integrity of the epiphyseal line, including the entire bony system, the short diaphyses and the skull. The relation of our histological to our radiographic observations is in the first case, a gummatous synovitis without certain bone involvement, in the second, the same with the severest epiphyseal and diaphyseal involvement, and in the third, gummata in simple synovitis.

XVI. On the Treatment of Bony Joint-Ankylosis. HOFMAN (Graz).—After mentioning the usually poor results and explaining the cause of failure Hofman describes a new operation. In order to prevent new ankylosis forming from remnants of cartilage he covered the defect with periosteum flap obtained from the tibia. The case was one of complete bony ankylosis of elbow and he resected the head of the radius and chiselled between the ulna and humerus. The flap was tacked (stitched) in place and passive motion avoided for four weeks, when the elbow was at a right angle. Primary union. The patient gradually took up his work and in eight months had rotation and

extension complete and flexion almost complete. Convalescence was painless; no forcible passive motion.

Two members of the congress recommended flaps of muscle or muscle and fat.

MILITARY SURGERY.

I. First Aid on the Battle-field. VON MANTEUFFEL (Dorpat).—The Russo-Japanese war can teach us little that was not already learned from the Boer war. Where shall first aid be served? Considering the long range of modern arms this must be about 4 kilometers behind the firing line, though in mountains it may be nearer. How many wounded are to be expected at the dressing station? About one-fourth of the total number. A surgeon can make about one hundred dressings in a night. The Russian army at Mukden had 75,000 expected wounded and for their care was needed 7,500 doctors, students, and helpers; 2,700 were enrolled, of which a larger part were in the reserve corps. The individual packet was properly used and justified itself.

The question as to the treatment of the skull was left open in the Boer war. Here Von Bergman's rule of "touch not" was proven correct in diametric wounds (*contre-coup*) with extrusion of the bullet. Without extrusion they should still await symptoms and Röntgen examination before operation in the reserve hospital. Otherwise with the tangential wound: must be operated as early as possible. In summer even they run an unfavorable course; in winter worse, because of the greater dirt. Without operation the wounds suppurate and then operation comes too late.

Operate in neck wounds for hæmorrhage only. In thorax, await effusion, and then in evacuating do it gradually as otherwise infection may be sucked from the lung. Wounds of heart, "touch not." Manteuffel has seen seven shot-wounds of heart heal smoothly. The spine gives nothing

new: only the old gloomy picture. In transverse palsy do not operate. If the palsy is not exactly transverse but irregular, laminectomy may be done. Improvements were few. Generally one should await possible absorption of blood-clot. Shrapnel wounds are generally infected; rifle wounds heal smoothly. Bladder wounds, from puncture, heal smoothly. With the extremities follow the old Bergman precept, do not disturb and plaster of Paris at once; this is established by both positive and negative trials.

II. Ability for Service After Wounds from Modern Weapons. SCHAEFER (Berlin), as recipient of the Langenbeck fund, made extensive studies in the field of the Russo-Japanese war. After the battle of Mukden he was enabled to examine over 7,000 wounded who again recovered sufficiently to return to their commands. The losses were undoubtedly great, but the percentage of loss not so unprecedented as the early reports showed. The percentage of wounded compares with that averaged in the Franco-Prussian war. The officers suffered more than the privates. The chances of the individual are shown in a table giving an average of 44 dead and wounded in every 100 men of the First Siberian corps. The relation of dead to wounded was 1-5.5. He reports upon the progress of the wounded. The percentage of deaths after wounds was remarkably small. Though many dead on the field were not reported, the prognosis for the wounded who were carried alive from the field, seems more favorable than in former wars. Surprisingly large was the number of wounded who were again able to report for service. Schaefer found about one-half of the wounded, after the battle of Mukden, able to serve after a period of three months. The report contains a classification of the wounds, as to the parts wounded and the nature of the missiles and weapons. Fifteen per cent. of all wounds were caused by artillery-fire. Mention is made of the operative activity at the main hospital stations, which was minimal. One division hospital counted but 10 operations in 2,000 cases of wounded.

Schaefer relates observations upon the effects of distance in gunshot wounds, and believes that the differences in the structure of the parts hit plays a greater rôle. In the end, he praises highly the first-aid outfits of sterile dressings carried by each soldier.

III. Experiences with the Dry-Dressing of Wounds in the Southwest-African War. GOLDAMMER (Hamburg) prefaces his paper with a mention of the many difficulties experienced by the surgeons in this war. These were largely caused by the constant poor supply of water and the enormous distances from field to base, rendered more considerable through poor means of transport. Under these conditions, dry dressings proved most valuable. Goldammer lays particular stress upon a combination of complete and exact fixation, with sterile dry dressing in all injuries to bones.

IV. Gunshot Wounds of Joints in the Russo-Japanese War. L. BORNHAUPT (Riga), as chief of the hospital of the Moscow-Iberian community, had 157 cases of gunshot wounds of joints among a total of 2,265 cases of wounds, about 7 per cent., compared to 4.5 per cent. in the Franco-Prussian war and 2.5 per cent. in the campaigns in Cuba during the Spanish-American war. The joint most frequently involved was the knee,—in 54 per cent. of all cases. The percentages of the other joints were about as follows: Elbow, 20 per cent.; shoulder, 12.1 per cent.; ankle, 6.3 per cent.; hip, 3.8 per cent., and wrist, 3.4 per cent. These figures have been nearly the same in all other wars. In these 157 cases 68.8 per cent. were bullet-wounds, 25 per cent. were caused by shrapnel and the rest were due to grenade fragments. Except in wounds of the ankle-joint, the other bullet wounds suppurred in 60 per cent. of all cases. Nevertheless these bullet wounds, excepting those of the knee-joint, all resulted well after conservative treatment.

The same plan of treatment gave good results in 95.5 per cent. of wounds of the elbow-joint and in 93

per cent. of wounds of the shoulder-joint. In all joints the impaction of the projectile increased the chances of suppuration 50 to 60 per cent. This impaction and the limited chances for proper transport of the wounded are considered the cause of the severe forms of suppuration encountered. Ready means of quick transport from the field of battle and competent means for fixation of parts at the place of injury surely constitute the two means of preventing many a crippling operation and many a subsequent death.

The hospital treatment of the cases without febrile reaction was an early massage and baths. Some cases were massaged after 5 to 6 days. After the least rise of temperature the massage was discontinued. Extensive hæmorrhages into the joints of the upper extremities considerably delayed the healing.

In many cases of injury to the knee-joint, the patients were able to walk at the end of two weeks.

Of all cases, 23.5 per cent. were operated upon—44 operations upon 37 patients—all these being cases of suppuration. Fourteen operations were amputations, one a disarticulation at the shoulder-joint. Ten amputations were necessitated in knee-joint cases. No deaths were reported after these operations, but mention is made of greatest difficulties encountered in the knee-joint cases.

Bacteriological researches established the following conclusions: Arthrotomy is indicated in all cases of streptococcic infection. Streptococcic infections of the knee-joint should not be arthrotomized later than a few days after injury. If in such cases the patient has been subjected to rather long transport, with perhaps unsplinted leg, no measure short of amputation should be considered. Knee-joints, with staphylococcic infection, may generally be treated with lateral incision of the capsule. In more severe cases the treatment should consist in a free opening of the joint, after the manner of *Textor*, the extirpation of the capsule, and thorough packing of the posterior wall.

Four cases of resection gave 25 per cent. of recoveries, and six arthrectomies 66.7 per cent.

Before deciding upon any operation on a pus-joint, aspiration and bacteriological examination of the pus are of greatest importance.

Of all cases reported, seven died. Of these two were hip—and five knee-joint cases. This meant a death-rate of 4.46 per cent., compared to 3.74 per cent. during the Spanish-American war.

All statistics and experience in this line speak most favorably for a conservative treatment of gunshot-wounds to joints. Secondary infection has been found to but rarely occur. Aseptic dressings, reliable fixation of the wounded joint, and quick and easy transport from the field of battle afford the means for best results.

The method of Bier may later prove of value in these cases.

V. Gunshot Wounds of Blood-Vessels. BRENTANO (Berlin) describes eight cases of gunshot wounds of blood-vessels, which were treated at the Charbin hospital of the German Societies of the Red Cross. The cases were alike in that all presented wounds inflicted by Japanese rifle-bullets (caliber, 6.5 mm.), and in all cases the skin wound of entrance had, at the time of admission, nearly or entirely healed. Of the eight, seven were operated upon. The eighth case revealed at the autopsy a gunshot perforation of the aorta. This patient lived seventy days after receiving the injury, and died of the results of secondary hæmorrhage, not of the perforated aorta, but of the liver. The operation in the seven cases consisted in free incision at the site of injury, double ligation of the vessel and its branches, and resection of same.

All cases recovered, free from any reaction or after-disturbances of circulation. Brentano condemns too early interference; especially in cases of extensive hæmatomata; in such the dangers of infection are great. Subsequent

suture of vessels is rarely possible. Such suture could be made only circular; on account of the extent of the defect could never be linear. Suture would be rendered difficult through the serous infiltration of the walls of the vessels, and their reduced elasticity, resulting from processes of absorption of the blood-exudate. Of the seven operated cases, four were tangent wounds, and three perforating. The first four were three of the brachial and one of the radial artery. The other three were of the external iliac, the femoral and anterior tibial artery, the continuity of the vessel being still preserved in all of these.

Brentano considers the perforating wounds as less likely to close spontaneously.

Of the tangent injuries to the brachial, two cases presented complete closure of the wound at the end of six days.

The closure was effected by a glueing together, through plastic exudate, of the vessel with adjacent nerves and fasciæ. The injury to the artery was undoubted, as the pulse peripheral to the wound was considerably weakened, or entirely lost. Added to this, the extreme toughness of the scar-tissue, and the disturbances of function in the adjacent nerves, left no doubt as to the presence of a lesion to the artery. The dangers of secondary aneurysms at the site of injury were additional indications for operative interference.

In three cases pseudo-aneurysms occurred, which were operated upon eight to fourteen days after the date of injury.

VI. Experiences with Gunshot Fractures of the Extremities during the Russo-Japanese War. COLMERS (Leipsic).—Injuries to bones from the small-calibered Japanese gun proved similar to those in other late wars, and confirmed the results and conclusions of experiments made by the medical staff of the Russian army. Colmers' experience leads him to tabulate the following advices:

1. No attempt at wound-disinfection should be made where the process cannot be carried out—*lege artis*.

2. First dressing should consist in an antiseptic or aseptic dressing, with compression, and the best possible fixation.

3. At the field hospital the only operation to be considered should be the urgently demanded amputations. Bleeding vessels should not be searched for nor ligated at that time and place.

4. Cases of gunshot-fracture should be given the priority of transport to the base-hospital.

5. During transport no change of dressings should be made.

6. The first dressing should not be removed before the patient is entered at some hospital where he can remain for the next two weeks, and this dressing should be combined with fixation by plaster bandage. The writer considers the plaster bandage the best form of retention; it easily permits of successful treatment of even badly splintered and infected cases. X-ray examinations are of great value, but can only be considered in the outfits of hospitals far removed from the field. These cases necessarily pass through the hands of a number of surgeons from the time of injury till the time when they receive their final exact treatment. The writer thinks it well to formulate a fixed plan for handling such cases and to instruct all surgeons to follow it strictly in every case.

VII. Injuries to Peripheral Nerves. HENLE (Dortmund).—Observations are upon comparatively old cases, as the hospital of the German Society of the Red Cross at Tokio was far removed from the scene of the war.

Among 276 patients, 34 (12 per cent.) presented injuries to peripheral nerves. For these injuries 21 operations were undertaken, or 10 per cent. of 195, the total number of operations performed. There were six simple neuralgias, and 11 combined with paralysis. Of these 17 cases six were cured without operation. Of the 11 cases

operated upon, two presented pressure effects upon the nerve, in one case through aneurysm and in one through a scar contraction of the pectoralis minor muscle. Cures resulted in both cases after extirpation of aneurysm and muscle. In four operations nerves and scars were dissected loose and imbedded in soft tissues, with three cases cured. In one case the median nerve was again exposed after three weeks, because the pain had not been relieved, and was again found encased in scar tissue. A part of the nerve was resected, and the site enclosed in a flap of fatty tissue taken from the abdominal wall. The pain ceased, as also in three cases of resection for complicating paralyses and two cases of plugging. A record of 11 cures in 12 cases operated upon. All of the 11 cases were relieved of their neuralgias. The conclusions tend to indicate in such cases operative interference to release the nerves or nerve-ends from scar tissues. The paralyses present more unfavorable conditions, as here often the duration of the affection plays a decisive rôle.

In the cases considered, this was but once as short as two months, usually from three to nine months. In all, 29 cases of paralysis occurred; eight cases recovered without operation; four cases were hopeless; 17 cases were treated by operation; three cases of release of pressure, (two aneurysms, one contracted pectoralis minor)—two cures; two cases of neurolysis—one cure; eight cases of freshening of nerve-ends and suture—three cures.

Suture was made with fine silk. Twice the line of suture was encased with flaps of fatty tissue, once with a portion of injured and resected brachial artery (method of Formatti).

The distance between severed nerve-ends proved too great in many cases to admit of any operative union.

Grafting of one nerve into another gave three results in six cases. These graftings consisted in suturing about one-third of the one nerve into a flap cut from one-third of the other.

Twenty operations were performed on 19 patients presenting paralyses;—nine cases improved, 11 cases without result. Of all but two cured, in the rest the missing functions were but partially restored. Too short a time was permitted to await final results. Most probably some of these cases regained better and greater functional powers of the muscles involved, after they had been dismissed. Stress is laid upon the importance of rapid transport of all cases of injury to peripheral nerves, to a point where exact surgical treatment can be administered.

VIII. Gunshot-Wounds of the Cranium. HILDEBRANDT.—With modern weapons, gunshot-wounds of the cranium were expected to be immediately fatal in most cases. Experience in recent wars has not proven this to be the case, and yet the mortality from such wounds is high—70 per cent. in the Boer war, with a table of at least 50 per cent. of recoveries of such not dying on the field.

The favorable results are ascribed by the writer to the treatment employed. Fatalities resulted mainly through infection. Good results can only be attained through measures which prevent or combat infection. Be it observed that the slanting (tangent) wounds present the more extensive lesions of scalp and bone, and incur the greater risk of infection. The only procedure that can check infection is thorough *débridement* (incision), the exposure of the dura in the entire extent of the wound, and the removal of bone splinters, blood-clots and detritus.

Deeper perforating wounds, with severe symptoms of brain disturbances, gave better results after this same procedure. The operation was desisted from in cases of apparently hopeless injury to the brain, and in cases of perforating wounds, with small and narrow wound of entrance, that were free from symptoms of severe brain disturbances.

V. BERGMANN (Berlin) condemns the early operations in any case of gunshot-wound of the cranium, especially in cases where the wounded must endure a transport lasting

5 to 6 days. He considers the operations in question as only indicated when undoubted symptoms of meningitis or abscess have arisen.

V. Bergmann opposes the method of Bornhaupt, of massaging recent cases of gunshot-wounds of joints, contending that we cannot be assured that foci of infection may not still remain encapsulated in the joint. He advocates long-continued treatment of such cases by exact fixation. He also admits that ligation of vessels on the field of battle must be performed at once in a number of cases to prevent death by hæmorrhage.

ZOEGE (Dorpat) maintains his position in advocating the free exposure of all glancing wounds of the cranium. Referring to his experiences in the fighting line, he finds it best to ligate freely bleeding vessels at the front, and not trust the chances of later operations upon aneurysms. Early ligation prevents (1) many fatalities from secondary hæmorrhage, and (2) infiltrations that obstruct collateral vessels, through pressure, often causing gangrene in the first 3 to 12 days after injury. Both conditions necessitate operative measures at once and mostly under unfavorable conditions. Zoege emphatically demands the use of aseptic rubber-gloves in such operations in the field.

IX. Abdominal Surgery in War. V. OETTINGEN (Berlin).—A summary of this paper presents, as most interesting, these conclusions:

1. Abdominal wounds with small encased bullets of small calibre are on the whole less severe than those inflicted by the former large lead bullets.

2. Exception may be found in the former class of wounds where they occur at short range (up to 400 yards).

3. The prognosis in any given case must be made with consideration of the following factors: i, Anatomical relations of the wound; ii, Condition before transport; iii, Manner of transport; iv, Treatment.

4. Theoretically, no abdominal wound from a modern bullet should be primarily laparotomized, with exception

of those cases preventing signs of continued hæmorrhage into the abdominal cavity.

5. Conservative treatment is indicated.

6. Abdominal wounds through shrapnel, grenades, and all artillery projectiles present the most unfavorable prognoses.

7. Theoretically these latter cases all demand immediate laparotomy.

8. Statistics show a few recoveries of such cases without operation, against a mortality of 100 per cent. in all cases operated upon on the field. So we must advise against urgent laparotomy, except at the hands of experienced surgeons.

9. About one experienced surgeon is met with in 20 medical officers at the front. These medical officers, who are not experienced surgeons, should be enforced to adhere to a well-arranged, uniform plan in the handling of all classes of gunshot-wounds, especially of abdominal gunshot-wounds.

10. The greatest good and safety to the wounded comes from strict uniformity of treatment on the field.

11. Statistics of the various medical organizations active on the field do not establish a very reliable summary on the subject.

12. Approximately, the mortality of abdominal gunshot-wounds, with conservative treatment, will be 45 per cent. on the winning side, and 55 per cent. on the losing side.

13. Laparotomy on the field cannot better these results.

14. Secondary laparotomy has probably saved many cases where primary operation would have been entirely hopeless.

15. Proper instructions to the individual soldier, and special training of *personnel* of the medical corps in the field, together with improvements in the methods of transport of the wounded, will be the chief means of reducing mortalities in the future.

HEAD AND FACE.

I. Lasting State of Sleep, after Fall upon the Occiput. RÖTTGER (Berlin) reported the history of a man who had lain for 18 months in a condition of sleep, eyes closed, forehead slightly wrinkled; he has spoken no word, nor shown the slightest alteration in his condition during three months of close observation. The interesting points of the case are the absence of every psychical function, and the cessation of every expression of will (patient never asks for food, etc.), and yet the functional activity of the sub-cortical and automatic centers is retained. Simulation and pressure are excluded. Röttger considers it a case of severe hysterical stupor brought upon a dull brain by the shock of a previous legal examination and then by the mechanical shock of a fall upon the occiput. Prognosis very doubtful.

II. Bloodless Operations on the Head under Diminished Air-Pressure, and Observations on Brain Pressure. SAUERBRUCH (Greifswald) said that after his work in the pneumatic cabinet on the chest, he had turned his attention to the influence of air-pressure on the organs and vessels. For example, he applied a pressure of 50 mm. of mercury to the livers of dogs and obtained thereby such compression of the vessels that the organ could be divided "bloodlessly." The accompanying compression of the diaphragm and lung makes practical application impossible. On the skull it is different, because here it is possible to localize the effect much more. Trephining under a pressure of 20-30 mm. is "bloodless." The danger of air embolism is wholly avoided. The application to humans depends upon the effect upon brain-pressure. This latter is treated in the original.—Memorial to Joh. v. Mikulicz, Grenzgebiete, June, 1906.

III. Osteoplastic Covering of Skull Defects. BORCHARD (Posen) recommended the Durant-Hecker method,

pushing under the scalp pedicled flaps of periosteum and bone. In 12 cases this has met all requirements, in one a defect 12 x 7 cm. was quickly covered by bone. Applicable to congenital defects of small children. He prefers a modification of the usual method where periosteum alone is used or periosteal surface is turned inwards. He simply slides a flap sideways so that the fresh bony surface comes in contact with the dura or the brain itself.

It is not necessary to take a thick bone-flap; a thinner avoids much hæmorrhage and applies itself better to the brain-surface. Absolutely necessary that there be primary union of the skin. Adhesions between brain and flap are little to be feared since these depend less on the surface of the bone-flap than on wounds of the dura.

Only when the latter is wounded do adhesions form, regardless whether periosteum intervenes or not. Indicated in all cases where immediate reimplantation is not possible.

IV. Operations in the Cerebellar Fossa. F. KRAUSE (Berlin) reported nine operations of whom none died of collapse, hæmorrhage or meningitis; one of the three fatalities was from pneumonia, two because the pressure could not be relieved by removal. The technique (given in full in Brun's *Beiträge*, 80th birthday celebration of Von Esmarch) is as follows: A flap is made with the base below which reaches in the middle line the occipital sinus, the transverse sinus above, and overlies the sinus sigmoideus. It is necessary to lay free these last two. He has abandoned the electric drill, uses the hand and the Doyen "borer," and the Dahlgreen forceps slightly modified. When the bony flap is turned down the dura is cut in the same line close to these sinuses and turned down. Then the hemisphere of the cerebellum lies free, and by turning the head to one side the rear wall of the petrous bone near the facialis and acousticus is accessible. By pressing the cerebellum to one side by a spatula these nerves may be seen (route to the Gasserian ganglion). If the cerebellum is pushed inwards instead of outwards, more from below

and without than above and within, the vagus, the glosso-pharyngeus and the hypoglossus come into view, into view of the bystanders more than that of the operator.

A completely successful case of extirpation of cerebellar tumor is reported.

BRAUN recommended puncture of the fourth ventricle upon the appearance of symptoms of cerebellar tumor, as there may be only a hydrocephalus of the former. Two or three punctures may then remove all pressure symptoms. Kraus always operates on both sides of the skull. He has no results from puncture of the fourth ventricle, and proposes instead its drainage.

BORCHARDT warned against the sinus marginalis which at times follows the margin of the occipital foramen. In many cases it is enormous, larger than the transverse sinus. It occurs in about 10 per cent. of subjects; always larger on the right side. Hæmorrhage from it could be controlled only by tamponade. From anatomical observations he makes his flap higher—4 cm. over the external occipital protuberance. To control hæmorrhage from the foramina emissaria he drives in small plugs of ivory or wood and cuts them off. He prefers to sacrifice the bone-flaps because their retention makes a complicated operation in itself. When both sides have been opened a breaking of the edge of the foramen magnum has been feared by some as thus endangering the medulla. This danger is slight, as the thick *membrana atlanti occipitalis* intervenes and beneath it is not the medulla but the "tonsil of the cerebellum."

Most difficult are tumors in the cerebellar-pontine angle, and he had had three such cases. In the first he had removed not only the cerebellar fossa but also the entire ear. (Most of these patients have already lost hearing.) In this way and by ligating and then dividing the sinus transversus he had thoroughly removed one growth, but tamponade was required for the hæmorrhage and the latter's pressure on the medulla caused death in forty-eight hours.

The principal danger in these cases lay in the nearness of the medulla and vagus, and in order to injure these as little as possible Frazier makes the valuable suggestion that part of the cerebellum be sacrificed. Borchardt in one case could not reach the tumor without such step; the resulting prolapse was so great that he could not return the organ and must remove a portion. No ill results were seen in the six days preceding death from inspiration pneumonia.

In another case it was necessary to remove almost all of one hemisphere of the cerebellum. After six months no ill effects, though there is probably a return.

There is a hernia at the site of the bone defect and behind this a collection of fluid requiring repeated puncture.

V. The Nature of Neuralgia and its Treatment by Chiselling out the Nerve Canal and Lining the Same by Soft Parts. BARDENHEUER (Cologne).—The cause of neuralgia lies in a venous hyperæmia of the bony canal, transmitted along the nerve from a peripheral hyperæmia, this becoming permanent because of the unyielding walls and leading to oedema, perineuritis and adhesions. This hyperæmia wanders in time to other branches, to the main stem and to the ganglions. Hence the above treatment accomplished by musculo-periosteal flaps from neighboring subcutaneous tissue.

He reports seven cured cases. In only one was a return, after 13 months, a case which suffered a fracture of the mandible during operation and later a severe phlegmon and bone necrosis. Later cured by excision of callus.

VI. Facial Neuro Plastic. STEINER (Berlin) reported a case of complete paralysis with reaction of degeneration of the facialis from early operation on the mastoid. Two operations, one laying free the facialis, were unsuccessful. Gradual implication of the other side led to the following operation. The accessorius was freed, difficult because of scar-tissue. The facialis was sought at its exit and there cut off. Anastomosis was not made laterally but per-

ipheral end of facial to central end of accessorius, leaving the distal accessorius near by. Improvement began with an itching four months later. Later a movement of the facial muscles with raising of arm or shoulder. More improvement expected. Steiner believes that the prognosis is better the stronger the involved muscles are.

VII. Paraffin Injection and Implantation on the Nose. ECKSTEIN (Berlin) said only one preparation is without danger, a hard paraffin which melts at over 50° C. This gives also the best results because of its hardness and its tendency not to slide later. Embolism comes mostly from too soft material. The serious misresult of blindness comes not at all after paraffin of high melting point. Generally such will not be absorbed.

When injection is not possible because of scar-tissue the implantation of carved pieces of paraffin (melting point 75° C.) is to be used, or a combination of the two methods.

VIII. Surgical Treatment of Facial Lupus. SCHULTZE (Duisburg) advocated the radical extirpation followed by Thiersch grafting. Involvement of the whole face does not militate against complete extirpation. If the mucous membrane of the nose is involved the nose is split; if the septum, the nose is kept open till cured within.

IX. Technic of Cleft-Palate Operations. BUNGE (Königsberg).—By means of a continuous Halstead (Cushing?) buried submucous suture the edges are brought together, and over this is placed the usual mucous sutures of silk. The first suture, which is of wire, has not been knotted and is removed by drawing upon the anterior end.

X. Functional Results after Extensive Removals of Cancer of the Tongue (via Mouth). HEIDENHAIN (Worms) begins with removal of lymphatics of the neck in the middle line and on both sides as far as the clavicle, at the same time ligating both lingual arteries. Pulling the

tongue strongly out it is divided squarely at its base, by Cooper's scissors, protecting at the same time the mouth. The papilla circumvallate can be thus brought to the teeth; if not, the anterior pillar of the palate on one or both sides may be divided by scissors. The functional results are good because the musculature of the mouth has been retained. Radical results also good (as were also Heidenhain's radical result as after cancer of the lips, in which a similar method was followed). In all cases both sides of the tongue were removed.

SPINE, NECK AND BREAST.

I. Operative Treatment of Gunshot Wound of Spinal Cord. BRAUN (Berlin).—A wound of a 5 mm. pistol under the fifth dorsal vertebra in a boy. Immediate complete paralysis, etc. Röntgen rays showed the ball in the canal. Shreds of clothing were found in the dura. The ball was not discovered until the cord was explored by puncture after opening the dura, then at some height; removed by longitudinal incision near the posterior roots. Great improvement after 22 months, and more expected.

In many experiments on dogs, in which foreign bodies were placed in the marrow, a large percentage soon died from early and severe paralysis, those of secondary healing not included. In a few severe cases the attempt was made to cure by removal of the body, once with remarkable success. In one case (of insertion) there was an early and complete recovery.

Indications for operation where there is known to be a body in the canal:

1. Directly proportioned to the severity of the cord lesion, aside from cases requiring operation because of comminution or infection.

2. Light cases with unimportant symptoms throughout or disappearing symptoms should be temporized with; small bullets often find room beside the cord, are difficult

at times to find in a good Röntgen plate, and are falsely localized.

3. Operate in cases with severe cord symptoms and slow or no improvement, which may not be explained by pressure or irritation from an intra- or extra-dural foreign body.

4. Operate only under the best extraneous conditions, good skiagraphs, and segment diagnosis.

II. Total Extirpation of a Median Neck-Fistula.

RIEDEL (Jena) reported a successful result after several operations had failed in the case of a fistula which extended over the front surface of the hyoid; 3 cm. above this it narrowed to a thread and reached to the foramen cæcum. In the former operations this thread had been overlooked, while in other cases the fistula has not been traced because it passed through the hyoid bone, then requiring the excision of the middle portion of that bone.

III. On the Third Thousand of Extirpations of the Thyroid. KOCHER (Bern).—Of these, including all kinds of cases, the fatalities numbered seven. The mortality is naturally greater in malignant cases, and of 36 such cases the fatalities numbered three. Here not the operation but the included ligature of the carotid communis or resection of the trachea or œsophagus is responsible. In eight cases of struma there were no deaths.

In 52 cases of Basedow, there was but one death, and this in connection with a secondary hæmorrhage which necessitated opening the wound.

There remain 904 of ordinary struma. Here were three deaths from strumous complications. One from secondary hæmorrhage in a congenital cachexia thyreo-priva, sensitive to blood loss. The second died of pneumonia after the wound had completely healed; known to have atrophy of heart and kidneys. The third had had from infancy a double recurrent palsy with stridor and pronounced myocarditis.

Thus is it justifiable to declare that at the present time surgical treatment is without danger to life even in deep-lying thyroids of considerable size and in old people, if their hearts are sound. The record of Kocher's assistant is one death in 661 cases amongst the more robust charity patients.

These results are a measure of what the results should be in other surgery, since this operation is more difficult than the generality of major operations and may require the extremes of surgical art, especially so the struma intra-thoracica.

Not one case of dangerous infection occurred. In 293 cases of benignant struma in private hospital there were but seven in which local infection appeared, and the average stay of these in hospital was 10 days. The simplest asepsis only is used. Much stress is laid on thorough checking of hæmorrhage, which is accomplished by the "Kocher hæmostats." Kocher clings to drainage because of Friedrich's experiments showing the great value of the outward flow in protecting from infection. He also believes that in Bier's treatment by suction (exhaust) at the proper moment, we have a most valuable resource in case of open suppuration. It is important to remove tubes as soon as the discharge ceases, in this clinic in twenty-four hours as a rule.

Danger lies in accompanying organic disease of other organs, especially of the heart. Every patient must be tested for absolute or relative insufficiency and suspicion of this or of disturbed compensation will be quickened by disturbed rhythm or dilatation. As soon as tachycardia and increased dulness appear, and particularly when these are combined with irregular pulse, the efficiency of the heart for increased demands upon it must be tested; this through exertion or tiring as by Gräupner, or through artificially increasing the resistance in the circulation as by Katzenstein.

A sinking of the pressure, measured "Riva-Rocci," from the mean of 150 mm. of mercury under 200 mm. marks

the prospective operation serious. The same measure together with the grade of dyspnoea marks the point at which general anæsthetic must be abandoned. Kocher abandons this whenever the patient is willing to bear some pain. For aside from its danger of a too low sinking of the blood-pressure, narcosis has the disadvantage of distinctly lessening the chance of avoiding the recurrent (in singers). Narcosis farther compromises the asepsis through vomiting.

To avoid these greatest of dangers, the heart complications, we have the old lesson to learn, early operation. And a greater, not to breed artificially a strumous heart by internal medicines which, in certain goiters, have no effect whatever; we mean the excessive and protracted use of iodine, and still more the frequent misapplication of thyroid preparations, which latter often produce more harm than good.

Increasing dyspnoea is generally required as a clear indication for the removal of a stenosing thyroid. But instead of treating the disturbed heart by medicine treat it by early operation; even among surgeons is operation a last refuge in Basedow's disease. Only in its early stages is operation without menace. Warning: do not permit an operation when there is heart insufficiency, as there certainly is in advanced Basedow's.

Early diagnosis of malignancy is not easy. Operation is certainly indicated in all rapidly-growing goiters, as it is in all these causing pressure.

One drawback is the development of slight hypothyroidism after partial strumectomy. This is to be avoided only by choosing in each operation the proper amount of functionally-active thyroid tissue to be left. If this harm cannot be avoided in cases of required excision then can the want be supplied by thyroid treatment, and here is the latter's most brilliant field.

IV. Compression from the Thymus Gland and resultant Death. L. REHN (Frankfurt a. M.).—It is cer-

tain that an enlarged thymus can produce characteristic pressure effects in the mediastinum.

In general it may be said that the thymus consists of two unsymmetrical lobes which are pushed into the forward part of the mediastinum like a cushion. It is enveloped in a fixed capsule and the anterior wall of this attaches itself to the side of the sheaths of the great vessels, the posterior passing over into the pretracheal fascia. It is loosely fastened to the upper part of the sternum close to the attachment of the pericardium and the large vessels. The capsule envelops the gland like a loose sack.

The arterial supply is not always the same. Generally the thymus artery comes from the inferior thyroid artery and the inferior internal mammary. The veins are strongly developed and empty into the innominate, the inferior thyroid or ima and the internal mammary. The nerves spring from the sympathetic, the lymphatics are sparse.

Close to the outer surface of the capsule run the phrenic nerves. The left vagus and the recurrent come also very near. The gland itself reaches tongue-like down to the pericardium. It covers from above downwards the innominate artery, the left innominate vein, and pushes into the space between the innominate artery, the right common carotid on one side and the left common carotid on the other, lying then on the trachea. This is the space which opposes resistance to the least growth of the gland.

As to evidences of narrowing of the wind-pipe by a large thymus, the author cited 28 autopsies in which pressure marks were found on the trachea and five operations on the thymus in which the existence of thymus pressure was demonstrated by the results.

It is not the weight of the thymus, not the size alone but its form which is decisive. A large flat gland may be without significance, a short thick one may create serious symptoms. Not only the form of the gland, but also the manner of its pressure may vary. In the new born the spot which is most imperilled seems to be where the innominate

artery crosses the trachea. In general there is often a flattening (of the trachea) from before backwards, often a lateral narrowing, indeed there may be a compression of one or the other bronchus. There is no regularity in this respect. Flügge reports another form of pressure, a pushing sideways of the mediastinal contents, and a case is contributed where the oesophagus as well as the trachea was compromised.

With every inspiration the thymus normally sinks into the thorax, with every expiration rises; the stronger the respiration the greater the movement. In children with large glands is often to be seen with expiration a small soft expansion above the manubrium sterni, a manifestation which may have pathological significance. Clinical experience teaches that in thymus stenosis as a rule inspiration only is hindered, and this is now easily explained from the above. The thymus exercises a valve-like influence, being aspirated to a degree during inspiration and pressed out of the thorax during expiration, thus forcing the thoracic organs.

The more forcible the inspiration the more is the wind-pipe narrowed. A slight lifting of the gland, a fixation by suture into its capsule banishes at once and permanently the stenosis.

Not always is the matter corrected so simply. In those cases for example where the gland has grown around the side of the trachea or where it presses hard and immovably. Such cases are often to be recognised by the expiration as well as the inspiration being hindered.

There is also a form of dyspnoea from enlarged thymus which sets in acutely, eventually leading rapidly to suffocation or rapidly disappears. The sudden, wholly unexpected onset of the apnoea is characteristic as is also the possible return attacks, with free intervals. Explanation is difficult. It can come, especially the clinical manifestations, only from a crowded mediastinum, rapidly coming and rapidly going. Such pressure could come from a certain bodily

posture. But we believe that an enlarged thymus which has not so far produced pressure symptoms suddenly begins to compromise the wind-pipe. The child will at once seek to get more air by raising the head, and if it increases this posture by lordosis (of the neck and dorsal spine) a lessening of the mediastinal space will presently occur. This position is significantly described by many reporters of thymus death. One may assume that the new born, infants with weak cervical muscles or men under narcosis may so die, but men capable of bending forward the head, never. Many cases require another explanation.

The thymus must be capable of sudden change in volume. "In my two operations I have noticed how little sufficed to bring about dangerous pressure, and conclude therefrom that slight enlargement may occasion strong effects." Slight swelling may arise through the gland's secretive capability. The small nutritive arteries certainly do not permit of any active hyperæmia but through constricted veins certainly a passive hyperæmia of significance can be produced. When we notice how suddenly a child with quiet breathing and good color becomes on crying cyanotic and with whistling stridor we can not banish off hand from the mind the possibility of a respiratory swelling. Whether the thymus may suffer swelling in infectious processes like diphtheria furnishes opportunity for surmise and very likely there are other such causes to be revealed in the future.

The author relates an example of sudden death from suffocation, in an adult, from congestion and swelling of the thymus. A young woman had been operated upon for Basedow's disease. The operation had proceeded smoothly. An hour later dyspnœa appeared and rapidly increased to suffocation. Autopsy showed the only obstacle to breathing was a remarkably large thymus gland. Ligature of the inferior thyroid artery to the inferior veins had undoubtedly caused a great change in the circulation and, as an immediate result, a great increase in volume of the gland.

A suddenly appearing dyspnoea may have been some time in preparation. To such cases belong those sudden deaths where section shows a flattening of or saber sheath form to the trachea.

The large vessels of the mediastinum appear to be able to resist the pressure longer, but cases are published by Hans Kohn, then from Ranke's clinic and by Lange of pressure on the heart and vessels.

Trachea stenosis from thymus pressure appears not seldom at birth and ends with death. In other cases are noticed in the new born a slight inspiratory sinking in of the front of the neck with restlessness, inspiratory stridor appears and eventually cyanosis. Or a typical feature is stridor upon suckling, and with this dyspnoea is generally lacking. Although nursing infants in particular are attacked, subjects in the later years of childhood, to four years and later, are not exempt. The narrowing of their air passages may occur rapidly as well as gradually.

The stenosis under consideration can thus appear in single attacks of dyspnoea, the child being indeed after the attack entirely free from difficulty. But every acute attack is dangerous, the first as well as the last. There is a familiar sequence, inspiratory stridor, enlargement of the thymus, thymus death. Ten years ago Rehn operated upon his first case of stenosis successfully. Then followed three by Fritz König, Purucker and Ehrhardt respectively. Lately Rehn has been obliged to attack another. The subject was a four months' old child of normal appearance and color. Since birth it showed the retraction of the neck with inspiration. Upon crying though the picture was changed in an alarming way, the face becoming blue, the inspiration noisy (stridor), the fossæ of the neck and epigastrium being drawn inwards. Cyanosis soon followed. In short, the apnoea was serious. The parents rightfully feared that the child might not "come round." As soon as the child was stilled the serious situation disappeared,

the child lay breathing quietly, only the lightly sinking neck remained as a warning signal.

The attack reminds one of spasmodic croup. The obstacle to breathing was unwillingly sought for in the trachea. But in expiration was noticed what appeared to be a round tumor in the fossa above the sternum, the constricting thymus.

The described form of dyspnœa, the inspiratory stridor of nurslings, passes with the laryngologists and pediatricists as a harmless ephemeral malady.

There may be many cases, seemingly harmless, where such symptoms are outgrown, where pressing symptoms never appear. But such cases remain in the highest degree perturbing. Who can foretell the incalculable dangers which threaten the lives of such patients? Did not Avellis see a child of four quickly and unexpectedly strangle and has not Moritz Schmidt related how in one family he saw three children die of chronic stridor while a fourth was suffering from the same disease?

Our clinical experience suffices, the often described thymus death with its clear characters of suffocation suffices to prove that this narrowing of the trachea by a large thymus is a very insidious, dangerous predicament. In every case unusual watchfulness is demanded. Dyspnœa of any severity is the indication for immediate operation whose objective point is the gland; tracheotomy, whenever it has brought relief, has not been sufficient to prevent death. General anæsthesia is not necessary. By a median longitudinal incision in the neck one reaches the pretracheal space by separating the sternohyoids. The capsule is recognized behind the manubrium which is extended with every expiration. The capsule is seized by hemostats (Péan's) and drawn out with moderate force. At times it is easy to do this and establish free breathing. At others the capsule must be at once divided. An extra-capsular extirpation is impracticable; the gland must be enucleated. In Purrrucker's and Ehrhardt's cases a large part of the

organ could be so removed. The latter speaks of a total removal: such is hardly possible. Koenig resected a piece. Even so much Rehn could not easily do in his second case since the glandular tissue tore off and disappeared deep in the thorax on each inspiration. With each expiration a further piece was obtained and finally the organ was carefully lifted up by means of a dull curette. For the sake of drainage the capsule should always be sewed outside the wound. All operations have so far achieved a perfect result. Never has it been necessary to remove the manubrium. Only in the rarest exceptions could that be necessary. In general this operation is a comparatively simple one.

As to the cases in which autopsy shows no narrowing of the air passages they may be classified as follows:

1. Those showing prodromal symptoms of stenosis.
2. Those in which there is not such prodromata, but which die under distinct symptoms of suffocation.
3. Those where death occurred unseen or instantaneous.

In the first two classes it seems that the thymus must be made responsible even if the later evidence of tracheal narrowing is wanting. The latter condition may depend on the manner in which the section is made; further, the narrowing may disappear at death. Both are quite possible.

The cases of the third class are doubtful in so far as they turn between death from heart failure and from complete closure of the wind-pipe, or whether there may have been any other cause of death. At any rate the indication to operate would be exactly the same whether the thymus hindered the air current or compromised the heart, directly or indirectly. But let us not deceive ourselves. The pathology of the thymus gland is as obscure as its physiology. A beginning has been made on its purely mechanical working. And how much waits on elucidation and explanation in this field! Purely hypothetical things like reflex effects from nervous disturbance and hyperthymæmia (Svehla) I have avoided. Also views of von Mikulicz on the influence of the

thymus juices on the thyroid. So much the more will we welcome thorough investigations in the field of physiology which would lead us to definite conclusions as to the purpose of the organ.

FRITZ KÖNIG said that he had operated twice in the last nine years on children with thymus compression. Both had attacks of inspiratory and expiratory stridor; the gland could be felt in the neck, and one developed a very convex vaulting of the upper thorax aperture.

For diagnosis other obstruction of the upper air passages must be excluded. Whether a real compression of the trachea or a compromise of the deeper lying nerves and vessels causes the symptom complex does not seem determinable in every case. In König's second case he found no improvement to follow resection and fixation of the left lobe and also deep tracheotomy; attacks continued. So he later removed the same lobe completely and enlarged the aperture of the thorax by resecting the sternum. There ensued a doubtful improvement and attacks have not yet reappeared.

König presented a nine-year-old boy on whom at three months of age he had partially resected the thymus and sewed it to the fascia. The improvement following the operation continued to recovery but immediately a severe rachitis developed so that the child did not learn to walk until he was four and a half.

This occurrence leads one to think of the relation which, according to Basch, may exist between the thymus and bone making. At any rate König holds it not justifiable (even when possible) to remove the entire gland; only partial removal should be done and eventual enlargement of the aperture of the thorax.

F. KRUMM had 11 years ago observed a case; a two year-old was afflicted with severe, gradually increasing dyspnoea, inspiratory and expiratory. Exact diagnosis was not possible and the following tracheotomy was without benefit. The next day's autopsy revealed a marked

enlargement of the gland which had developed mostly in the angle between the trachea and right bronchus, and here had caused a high grade of compression. Within the thymus was a lobular cavity which was filled with a yellow-gray, viscid, pus-like fluid. The process had nothing to do with real abscess formation or with syphilis as had been accepted, but certainly was an abnormal degenerative process. Mobilization was impossible because the large vessels ran for a distance in the thickened wall of the gland. Incision and drainage would certainly have saved the child.

V. Transplantation of Thyroid Tissue into the Spleen. PAYR (Graz).—A distinction must be made between functional and morphological transplantation.

About one-sixth of the animals in which the thyroid was completely removed and transplanted in whole or in part, survived without functional disablement, a striking result reached by no other experimenter. These successful results occurred in unbroken series. Many failures can be attributed to technical faults, to lack of the scrupulous care required by these animals in captivity and to many intercurrent maladies. Of those animals which did die from insufficient thyroid function only a few suffered from tetanus.

To add to the test many animals were kept in unheated rooms in winter and survived. All that were subjected to extirpation without transplantation died, usually with tetanic features.

Morphologically. The inserted piece is found to be reduced to one-fourth or one-third its original size, but the contrast between its color and texture and those of the spleen is marked. At times may be seen on the thyroid section surface brown pigment.

Microscopic examination shows that by Payr's method of transplantation the primary central necrobiosis is much less pronounced than usual, often entirely absent. Regeneration on the part of surviving grafts is very distinct.

The retention of colloid after long periods is very

variable; often, as found by other observers, it is very distinct, especially on the periphery, in other cases very slight but evenly distributed over the section. Many fields show after three to nine months the appearance in every particular of normal, colloid-forming thyroid tissue.

The difference in the results of different experimenters has been very great. Payr explains this by the varying physiological "gift" of each organ, those with "inner secretion" being naturally more adaptive to transplantation.

Since Kocher's advance in 1883 such transplantation has been done in man. The results were mostly negative, or transient when the first effects were even striking. Payr transplanted a piece of mother's thyroid into the spleen of a six-year-old child suffering from typical infantile myxedema. Three and a-half years of thorough thyroid treatment had been futile. The improvement during five months has been great both intellectually and bodily.

Incidentally these experiments teach some technique. The naturally copious bleeding from the spleen is at once stopped by the action of the inserted thymus tissue. The incision is then closed by sutures of fine silk reaching some way back. In this way and by adapting the pocket in size and shape to the graft bleeding was controlled in every case (and many of the dogs were large). In several cases magnesium was used in suture, in others a form of cobbler's stitch with omentum used as a living material to prevent cutting out. The first and simplest method generally sufficed, but with it the omentum was generally tacked to the suture line. The choice of the edge of the spleen for the pocket instead of the convexity facilitates the suturing and enables the stitches to be passed some way back, thus preventing tearing out. Payr accordingly points out that in the treatment of punctures and incisions of the spleen, similar suture may be quite suitable, while in rupture the usual extirpation should be adhered to.

KOCHER said that he had had occasionally remarkable

results also, usually in the implantation between peritoneum and parietes. He has implanted all possible organs including veins, femoral artery, etc., but most of the subjects die. Lately is a new method in which very small pieces are implanted.

Payr replied that his extensive experiments lead him to doubt the value of small pieces, for in the act of detachments and transplantation a part of the graft always dies and the proportion of the surviving part to the whole graft is small.

VI. Experiments on the Infection and Bacterial Absorption of the Pleura. NOETZEL (Frankfort a. M.).—The frequent suppuration of the pleura after injury or operation has led to the presumption that, unlike the peritoneum, it has very slight power of resistance. These experiments show the contrary, that its natural powers of resistance are great, and greater than those of muscle and skin. This resistance (and power of absorption of bacteria) is broken, however, by the pneumothorax which so often accompanies injuries. Absorption was rapid, as it is through the peritoneum, and but five minutes sufficed after implantation of bacteria (pyocyaneus) to find them in the blood and internal organs. But this absorption is not the cause of the protection, any more than it is in the peritoneal cavity. That comes from the check the bacteria receive in these cavities directly through an immediate leucocyte-bearing exudate, the latter being later absorbed.

VII. On Gunshot-Wounds of the Heart. GOEBELL (Kiel) presented a young man upon whom he had operated for pressing symptoms one hour after the receipt of a 7 mm. shot through lung and heart. Goebell made a Wehr-Pagenstecher (osteoplastic) flap, found the lung apex perforated, and sutured it. From the wound in the pericardium blood flowed copiously. A furrowed wound was found on the left ventricle, entrance almost 2 cm. long, exit almost 3 cm. behind this of same length; 100 c.c. blood in pericardium. Entrance closed by four iodine

catgut sutures, the exit by five. Thereafter it still bled in a stream from a corner of one wound. This was stilled by one more suture, oblique and far-reaching. Suture of pericardium, pleura and the "double-door" flap. A thin drain was left twelve hours. After twenty-four hours the pneumothorax was aspirated. Now the patient is able to work and the heart is sound.

The diagnosis of lung and heart wounds at the same time is difficult. Goebell recommends that in cases of gunshot of this kind when the outlook is serious, to assure oneself whether the heart is wounded. If it is it must then be laid bare. In this way one can use the exploratory incision according to the direction and position of the bullet-tract. A fixed method is not to be recommended.

VIII. Suture of Heart-Wounds. WENDEL (Magdeburg). Since about 100 reported cases of injury of the heart treated by suture have given 44 per cent. of recoveries, the justification for operative treatment of such cases can no longer be opposed. As to the technique of the operation, however,—especially as to the method of exposing the heart,—views are still considerably at variance. The writer has successfully applied sutures in one case of perforating stab of the left ventricle, in a nineteen-year-old boy, and this not in an operating-room with all its favorable surroundings, but in the country, at the place where the wound was made, in the common room of a peasant's house, with the extremely poor light of lanterns and with very limited assistance. The operation was performed five hours after the injury. During four hours the wound had been imperilled by continuous explorations by the finger of the surgeon first consulted. The pleura was not injured. In consequence of this, the wound, enlarged by the first surgeon, and situated in the left intercostal space, did not admit of the proposed flap method for exposure of the heart. Instead, the wound was farther extended and as the injury to the heart was brought into view an irregular flap, with base below, was formed.

Most of the happy result in this case is to be referred to the lack of complication on the part of the lung and pleura. When, therefore, a typical method for the operation should generally be recommended, it should not be transpleural but extrapleural, and even also for those cases where the pleura is wounded. For almost half of the cases have been lost by septic infection passing from the opened pleura to the pericardium. It is therefore preferable, in cases where the pleura is wounded, after extrapleural exposure of the heart, to suture the edges of the pleura as well as the pericardium, and if an empyema follows to treat it, in the ordinary method, by resection of the ribs at the most dependent point behind. After consideration of the reported operations to be found, the writer therefore recommends Kocher's method, with the remark that generally a precise method is to be preferred.

IX. On Injuries of the Heart and Heart-Suture.
C. SULTAN (Leipsic) presented a patient who on the fifth day after a punctured wound of the chest, developed signs of hæmorrhage into the pericardium; collapse, increased area of dulness, soft murmurs. The pericardium was closed by suture except for the passage of a small drainage-tube. The pleura was not drained.

A second patient operated on by Sultan died forty-eight hours afterwards from a wounded and at first thrombosed internal mammary artery. The sutured wound was in this case, as in the preceding, situated in the left ventricle; the autopsy revealed besides a second puncture leading into the right ventricle and partially closed by a thrombus.

A preparation of the heart of this last case was presented; also a photograph of a heart the left ventricle of which was pierced by a sewing-needle, which was healed over. Another preparation was presented which was made from a man, fifty-three years old, who had jumped from a height and suffered such severe injuries that he died five days later. There was a long laceration in the pericardium

and the heart was wholly displaced into the pleural cavity.

Sultan considers the extrapleural operation to be but seldom applicable. Generally the pleura is wounded as well as the heart. Besides, the diagnosis of wound of the heart frequently cannot be positively made; we must often, upon beginning the operation, be satisfied that an intrathoracic hæmorrhage has taken place. Often the situation will be so serious that the surgeon must sacrifice the demand for a careful and methodic sparing of the pleura, to the rapidity of operation which is imperatively demanded.

BRACKEL (Libau) reported a case of injury to the region of the heart made by a splinter of granite, which was followed by purulent inflammation of the pericardium. The fragment of granite was removed from the pericardium, together with some fragments of clothing, and a tampon was placed upon a small laceration at the apex of the organ. The patient died of pneumonia fourteen days later.

BORCHARDT (Berlin) presented a boy in whom he had, some years before, sutured a penetrating wound of the heart.

JAFFÉ (Posen) agreed with Sultan, that during treatment of a punctured wound of the heart, at the opening of the pericardial sac, and on the introduction of the sutures, severe hæmorrhage may occur, so that the action of the heart, already embarrassed, may fail entirely. At such critical moments, according to the experience of the speaker, the following measure is of service, so long as the heart yet retains any vitality: The suture being rapidly made, by means of a Pravaz syringe the left ventricle is filled with the physiological salt solution; the no-longer-beating heart immediately resumes its action.

ZAWADZKI (Warsaw) recounted the history of a young man, nineteen years old, who received two wounds from a revolver fired at close distance. One was in the left forearm, a second in the fourth intercostal space, between the left edge of the sternum and the left mammary line.

No wound of exit. He saw the patient a few minutes after the injury. He did not complain, was pale, but pulse regular. After temporary dressing he ordered the patient taken to the hospital, which could only be done after two hours. On reception the patient was somewhat pale, pulse regular, but rapid—120. By the Röntgen rays there was plainly seen upon the screen a dark shadow in the region of the heart which exceeded in diameter an ordinary revolver ball. During the night and the following day the patient was feeling very well, no effusion of blood into the pericardium or pleura, no hæmoptysis. In spite of orders the injured man walked about the ward. After fourteen days two Röntgen examinations were made, one of the breast, the other in the dorsal position. In the first was seen two small projectiles lying close together, and at the second one also saw the two bodies, but much larger. Since the distance of the tubes from the plate in both examinations was about 45 cm., it was thought that the ball was situated nearer the pectoral surface. In view of the existence of but a single wound it was singular that at both examinations two projectiles (bodies?) were seen. Since it was impossible to assume that two balls could enter through a single external opening, they thought they were justified in believing that there had been a splitting or division of the ball. Since the opening was quite small, the edges smooth and the pieces of ball lay close together it was concluded that the division of the ball must have taken place inside the body.

ABDOMEN AND ABDOMINAL ORGANS.

I. Tampon Drainage of Abdominal Cavity. DREES-MANN (Cologne).—In view of the various disadvantages of the methods of drainage heretofore resorted to, Dreesmann advises the use of glass tubes, 1-4 cm. in diameter and 5-20 cm. long, which are closed below and have lateral openings not over 0.2 cm. in diameter. Tamponing and absorbing gauze is placed in the tube and changed

several times daily, without difficulty and without the slightest discomfort to the patient. Except that in the tube no gauze is introduced into the abdomen, unless it be in cases where a considerable hæmorrhage is anticipated. The method has been followed for three years past, and in cases of perityphlitic abscess, abscess in Douglas' cul-de-sac, after cholecystectomy and choledochotomy, resections of the stomach and colon. In a few cases—3 or 4 times in about two hundred cases—when the openings in the tube were too large, or the gauze was not sufficiently packed, granulations extruded through the openings. By rotatory movements the tube was easily removed; if necessary galvano-caustic destruction of the granulations under illumination, might be resorted to. Intestinal necrosis, which has been observed by others, did not occur. The tube should be stitched to the external parts. [The translator has had such tubes sixteen years, and they are now in his collection of curiosities.]

II. Technique of the Operation for Femoral Hernia.

SPRENGEL (Brunswick) proposes a new procedure in the treatment of certain femoral hernias in women; the operative closure of the internal ring of the femoral canal, made through the abdominal cavity. The operation consists of the following steps:

1. In the flat position with head lowered, free exposure of the sac by linear incision, opening and examination of the same, and clearing of impacted contents.
2. Transrectus laparotomy on the side of the hernia, damming back of the intestines and the organs of the lesser pelvis.
3. Introduction of a Mikulicz forceps through the femoral canal into the sac and invagination of the same into the abdominal cavity.
4. Firm rolling together of the sac and suturing of it over to the internal ring, together with pulling forwards and suturing of the round ligament of the uterus, lying in immediate neighborhood of the inguinal canal.

5. Closure of the abdominal incision and the linear one over the femoral canal.

Five cases, of which the largest standing was of ten months, gave a perfectly satisfactory result. In one of the cases there was double femoral hernia with beginning prolapsus uteri. The uterus could be considerably elevated by the above procedure.

This method is adapted according to Sprengel, not to small recent hernias, but to old ones of large size and to recurrent cases. It is apparently easier and less dangerous than complicated plastic methods.

III. Technique of the Radical Operation for Large Umbilical and Abdominal Hernias. E. GRASER (Erlangen.)—The problem of a good and lasting closure in the case of large hernias is a very difficult one. Even after carefully performed and successful operations, there follows often a relapse. The larger the hernia the smaller the chances of an enduring cure. Busse reckons, from the statistics of Eiselbergs, clinic at Königsberg in 1901, 43 per cent. of relapses. In large hernias the prospects of permanent cure are yet worse. Also, the numerous propositions for new methods and for modifications, everywhere made, speak loudly for the unreliability of the procedures heretofore adopted.

We are at present satisfied with the results obtained by our method of suture after laparotomy, application of sutures in layers with exact union of the fascia. Cases of umbilical hernia are generally more unfavorable on account of the tension of the abdominal wall often present, particularly in obese patients, and also on account of the lateral strain of the abdominal muscles, which endangers the cicatrix. An important advance was made in 1893 by Gersung. It consisted in freely exposing and sewing up the recti muscles. This is often however very difficult and the tension, in large hernias, a great obstacle.

The favorable results obtained by Pfannenstiel in reference to avoidance of cicatricial hernias of the abdomen

by means of his transverse discision of the fascia above the symphysis, brought him very near to this method of avoiding separation of recti. Following this suggestion Menge¹ operated upon some cases. At the conclusion of his communication he recommended a modification, that the anterior sheath of the rectus above all be saved from injury, and he advised incision of the posterior sheath, in order to be able to effect release and suture of the recti as high and as low as possible. Graser had performed this kind of operation four times in cases of large umbilical and abdominal hernias and can strongly recommend the method. The undertaking is a serious one; the operations lasted to three hours, the enormous wound surface exposed and the numerous imbedded sutures in the usually very adipose abdominal walls are a strenuous trial on asepsis; but the course of the cases and the result surpassed all expectations.

The principal incision is made transversely over the highest point of the abdominal tumor, its length varying from 35 to 50 cm.

The hernial sac is opened, adhesions of the intestine freed, the trimmed part of the sac brought to the hernial ring. Now a separation of the sheaths of the recti into an anterior and posterior flap is absolutely necessary, and since such a division in the region of the cicatrised hernial ring is very difficult to effect, the anterior sheath of the rectus is to be divided transversely as far as the external border of the rectus, often widely displaced laterally, and now the entire anterior aponeuritic flap is to be lifted up. Where a division (separation) is not possible, the commissure of the rectal sheath is to be split along the inner border; in doing this the operator must most carefully avoid injuring the anterior layer, and make the division rather towards the posterior layer. Above and below, where the recti approach each other but do not touch, a longitudinal incision is made, near the linea alba, so that the fibrous structure of this remains in contact, as a stiff ligamentous layer.

¹ Zentralblatt für Gyn., 1903.

After preparation of this flap, the peeling out of the rectus is to be effected, and in the most careful manner by the finger or by the Kocher goitre sound. The loosening must be very carefully made as well from the anterior as the posterior sheath, with preservation of the nerves. This is often very troublesome, but is successful with intelligence and saving care. Only when the loosening is completed can suture of the omentum be proceeded with, and best simultaneously with closure of the posterior sheath of the rectus. On account of the tension stay sutures are generally necessary. Above and below the union can only be made in vertical line on account of the linear incision; occasionally some transverse seams may be added to diminish the gaping.

Now follows, and likewise in vertical direction, the union of the rectus muscles by interrupted sutures, some of which are passed deeper; others above these draw the edges somewhat over each other. When the muscles are well isolated, this can be done without much tension, the muscular fibres bear this badly, especially as they are mostly atrophied. But really it is generally astonishing how well-preserved are the bellies of the muscles.

Now the edges of the anterior aponeurosis are trimmed and exactly joined by a right solid row of interrupted sutures (iodized silk or catgut). If there is a surplus (of tissue) one flap can be pushed under the other and thus the line of union doubled, as Mayo has taught.

A hand breadth of skin, together with adipose tissue, can generally be removed, in which case deep sutures must be passed through the adipose.

The fear that the anterior fascia may become necrotic is shown by experience to be groundless; also, that the remaining soft parts may not suffice for covering, by the result in this particularly difficult case. It might indeed be quite impossible to draw together the edges of the hernial ring, with inclusion of the recti muscles; but it is entirely different when the fascia and aponeurosis, thickened by chronic inflammation, are again unfolded.

Most careful attention was given to cessation of bleeding. A glass drainage-tube was only once introduced at the side; the cavity, however, is so large that little can be expected from a single drain. A sand-bag was continuously applied.

In view of the large eventration a course of preparation was followed for about four weeks. It consisted of rest in bed, moderate fluid diet, daily alvin evacuations, compression with heavy bags of shot, daily taxis; every symptom of bronchitis allayed; digitalis administered.

Until the occurrence of the first passage from the bowels the condition of the patient was most serious; after that occurred all anxiety disappeared. Healing of the wound was undisturbed.

The worst case presents now, after the lapse of a year, a most satisfactory condition. The last examination seems to give assurance that there will be no relapse. The operation is particularly to be recommended because it establishes a condition closely approaching the normal anatomical.

KAUSCH (Berlin) has applied a net of silver wire in two cases and had relapses. The stiff net was simply torn. In this case Kausch exposed the recti, united there vertically above and below and drew the hiatus together in star-form with bronze-wire cross-stitches.

SEEFISCH (Berlin) advised giving physostigmine to prevent meteorism after the operation.

HELLER (Stetten) likewise advised physostigmine.

SPRENGEL (Brunswick) had doubled the fibrous ring and thinks that no fibrous tissue should be sacrificed.

WULLSTEIN (Halle, S.) in experiment on the cadaver had drawn down the pectoralis major; had not done it on the subject, however, on account of disturbance of innervation. He had divided the one aponeurosis anteriorly, the other posteriorly, and then the flaps.

In this way the recti came well together.

GRASER warns against sutures through the recti with tension. The suture which is thrown around the recti is

to be unconditionally rejected. Kausch will certainly have relapses. So, also, Graser opposes all muscular plastic as useless.

IV. Operative Treatment of Ulcer of the Stomach.

KRÖNLEIN (Zurich).—It is established that a considerable number of cases are not to be cured through internal therapy and that the immediate favorable results are often disturbed later through reappearance of the symptoms or serious complications. Many of these are finally cured or improved by later operation. The direct mortality from operation has been much reduced and is now eight to ten per cent. The late results are most satisfactory, complete cures in 61 per cent. distinct improvement in 24 per cent.—that is, a distinct result after a year in 85 per cent. The late mortality is very slight, depending mostly on carcinomatous degeneration. The cure comes in part from cicatrization, in part from the reestablishment of proper motion and secretion. Dilatation retires rapidly. The normal secretion and acidity are rapidly reestablished.

If the acidity was normal it sinks after operation below normal and then recovers itself. If it was decreased, then it becomes after operation normal or increased. It is seldom unaffected or permanently lessened. Free HCl is generally present after operation, in small quantities as before; sometimes it is abolished to be later resumed; where there is none before it is generally discoverable after. Subnormal acidity and lack of HCl cannot be considered disadvantageous. They cause no discomfort and are caused by the freer drainage of the stomach. The reflux of bile in time disappears; of pancreatic juice is very rare.

Choice of operation.—The operative aim is not the excision of the ulcer but the restoration of normal function favorable to healing, this is best attained by posterior gastro-enterostomy. Results are startling and more so the greater the previous disturbance. It is of value also in hæmorrhage and callous ulcer.

The excision of the ulcer should be exceptional; be-

cause ulcer is often multiple, hard to find, and its excision sometimes difficult. If undertaken it must often be combined with gastro-enterostomy. Pyloroplasty has no more justification; resection of the pylorus for stenosis and ulcer only when cancer is suspected. Instead, gastro-enterostomy.

Indication for operation.—Stenosis of pylorus of every grade. Every case of gastrectasis and gastroptosis of distinct grade where internal treatment has proved indifferent. Slight but oft-repeated hæmorrhage. In fulminating hæmorrhage the risk of delay till recovery from the attack seems less than that of immediate interference. If immediate operation, gastro-enterostomy merely should be tried. [Many statistics follow.]

RYDYGIER pleaded earnestly for gastrectomy on the ground, that the resulting conditions were nearer normal. Only by removal of the ulcer can we have a lasting cure. Gastro-enterostomy provides favorable drainage only, gastrectomy adds elimination of the ulcer. If there are multiple ulcers at least the worst are removed, "callous ulcers," those which affect the outer walls most. Gastrectomy provides for the mixing of gall and pancreas in the proper place, thus avoiding peptic ulcers. Gastrectomy hastens and assumes the healing of callous ulcer. These are known to heal after gastro-enterostomy, but so is death from unhealed ulcer known to follow the same operation. One operator lost in fifteen months two patients from hæmorrhage and two from perforation, where the ulcer had been left. In two to five and one-half years after 33 gastro-enterostomies only nine remained cured! Statistics fail because if autopsy shows cancer the cases are counted with operations for cancer, whereas cancer is known to develop on ulcer after gastro-enterostomy. The operation is thus twice to blame, once because it has failed to cure and again because it has abetted carcinoma-ulcer.

The frequency of carcinoma-ulcer is five to thirty per cent. If we are to remove cancer at the earliest we can

accomplish it by adopting gastrectomy more frequently for ulcer. We know certainly when cancer has begun by its development into an ulcer. The immediate mortality is more than in gastro-enterostomy, but is now reduced in some clinics to three per cent. But it is less dangerous than cancer. Rydygier presents a case of resection done twenty-five years ago and still in good health.

KOCHER prefers the anterior gastro-enterostomy because it gives better results and is quicker.

KAUSCH first attempts pyloroplasty and if that is impossible then gastro-enterostomy.

KELLING prefers the posterior anastomosis with entero-anastomosis. Has had three deaths in 74 cases. Three-fourths were long cured. A portion had relapses, even serious bleeding, but the latter was more easily cured than before. When an ulcer does not heal spontaneously it is because of unfavorable situation near the pylorus, unsuitable floor (liver or pancreas) gastropptosis and constitutional causes. The first three are favorably influenced by operation.

KÜMMEL pointed to the importance of early full nourishment.

KÖRTE.—In perforation the prognosis is favorable if operated within twenty-four hours.

KATZENSTEIN.—The chemistry of the stomach is overlooked as a factor in gastro-enterostomy. Krönlein has observed the effect on the mechanism of the stomach before and after this operation, through stomach fistulas in dogs. After all sorts of anastomosis fluid from the jejunum was seen to flow into the stomach. This caused of course a disturbance, nervous-reflex as well as chemical. The fat is also digested somewhat in the stomach by the gall and pancreatic juice there. Indeed after gastro-enterostomy the stomach digests fat freely and Katzenstein can give his patients freely of mayonnaise, more than normal man can stand. On the other hand much albumen, which is easily digested in the normal stomach is disturbing to these

stomachs. Conclusions: 1. Gastro-enterostomy causes the ulcer to heal not by prompt emptying, for this may be no more prompt than in the normal stomach; much more from the reduction or disappearance of the formerly excessive HCl. 2. Recommends a preponderance of fats, cream, etc., in the earliest days. This neutralizes the bile and pancreatin, postoperative vomiting is avoided, and the patient recovers rapidly because of the assimilation.

HANS LORENZ (Vienna) reporting Hochenegg's clinic, held resection, circular or segmentary, as rarely justified; and segmentary without at the same time an anastomosis with the bowel as inadequate. In resection one may overlook ulcers, but with anastomosis the stomach is placed in a condition to cure them. He avoids resection even for callous ulcers, unless these are torn during operation, and his results have been remarkable, the healing being anatomical and not clinical. He prefers the posterior operation by suture of the highest point of the jejunum in a direction so that the peristalsis corresponds. Thus is the vicious circle and peptic ulcer avoided.

GRASNER reported specimen of fatal hæmorrhage four years after a posterior anastomosis by the Murphy button. The orifice had contracted to the size of a lead-pencil.

Symptoms of pylorus stenosis may be very slight; retention and vomiting may wholly fail, and pain only be present.

He has abandoned the Murphy button because the saving in time is slight, narrowing follows and he has seen it cut through before adhesion. Pyloroplasty has been abandoned because operation must be repeated for renewed stenosis.

FIBICH presented experiments showing that gastro-enterostomy cured ulcers even when the blood-supply of the stomach was interfered with. Rapid drainage of the gastric juice did not explain the effects of gastro-enterostomy for removal of the gastric juice through a glass tube without

removing the liquified food had no effect on the artificial ulcer.

CLAIRMONT, speaking for Eiselberg's clinic, could not share Krönlein's very favorable opinion as to the late effects. His favorable late results were but 58 per cent.

Ulcers near the pylorus are benefitted more than those at a distance or on the lesser curvature. Attempts have been made to choose the operation according to the location of the ulcer. All plastic operations are rejected. Cases of perigastric, where there is no gastric ulcer nor cholecystitis, come from duodenal ulcer. Of 172 ulcers 10 were of the duodenum.

BRAUN rejected resection.

NÖTZEL.—Of 13 perforations of the stomach, seven were healed, the earliest of course with the better results. The technic for perforation is excision, a threefold suture, thorough irrigation, tampon and counter drainage on both sides, even when no peritonitis. Most of the healed remained free from all annoyance and a late autopsy showed an ideal cicatrix.

BARTH.—If ulcer of the duodenum is near the pylorus its symptoms may be the same as stomach ulcer, or they may be confined to local pain, or pain near the spine. As most cases die from perforation or hæmorrhage nothing remains but to operate (gastro-enterostomy) in all doubtful cases.

BRODWITZ demonstrated a peptic ulcer which had followed a gastro-enterostomy done two years before for pylorus stenosis. Resection, and thereafter patient was kept on bismuth to prevent recurrence. In spite of this, recurrence five months later. For increasing discomfort, jejunostomy. Still no distinct improvement. It was now discovered that when nutriment entered the fistula it caused a free flow of gastric juice. It is then a mistake to expect jejunostomy to exclude stomach function. The cause of peptic ulcer lies in some unknown individual disposition.

V. On the Diagnosis of Hirschsprung's Disease (Dilatation of the Large Intestine?). NEUGEBAUER (Mährish-Ostrau).—Both examination and history permit the diagnosis to be made with the highest probability. The previous methods of examination, distention with gas and filling with bismuth are to be avoided, the first because it has caused serious elevation of the diaphragm, the second because of great accumulation of feces. The proposed method is simple, to introduce a spiral metal sound high in the bowel. In these two cases this was easy. It is then skiagraphed and can then be seen in its course to the right of the navel and then to the diaphragm with great distinctness, and left no doubt that one has to deal with an enormously dilated sigmoid. The fluoroscope suffices, and in this way certainty can be at once attained in doubtful cases. The possible course of the sound in normal cases to the ascending colon is extremely unlikely.

One child died of intestinal catarrh and the other was operated upon. There was no valve obstruction in either, and both showed dilatation of the transverse colon and sigmoid, one of the rectum also. In operating, the undilated point of the colon was joined to the rectum. This patient, who never had a natural stool, is entirely cured. The liver dulness is restored. The success of the anastomosis shows the absence of valve obstruction.

VI. On the Further Development of the Operation for High Cancer of the Rectum. KRASKE (Freiburg).—In the past laparotomy has been used as an aid when the approach from below has failed. Kraske proposes the combined operation to be planned deliberately, and begun with laparotomy. There is end to end anastomosis and preservation of the sphincter. The mortality is high, but this is explained by the fact that the operation is adopted for only the severest cases.

KÜMMEL.—When the growth is movable and not circular he stretches the sphincter and draws the growth through it. When higher he uses the parasacral or sacral

route. Still higher, laparotomy. The mesentery is tied off as high as the transverse colon, incision of peritoneum and clearing out of the fibrous tissue of the pelvis, then invagination (through the anus) or closing of the peritoneum and excision of the growth through a pararectal incision.

KOCHER believes that one must first decide if he is to do an upper or lower operation; the former when the growth lies wholly within the region of the abdomen; the sphincter can then be saved; the deeper cancers only from below. The more dangerous combined method only rarely. Once with a sure diagnosis of cancer he operated from below and found no cancer; from above and found a cancer of the colon which was pressed downward by feces.

REHN considers the combined method very dangerous. One should operate rapidly. The pressing end should be sewn in the wound in order to see if the circulation be restored (gangrene) and finish with a second sitting.

HANS LORENZ.—This method must be welcomed as a present advance when (1) it affords a means of extirpation otherwise impossible; (2) when it is less dangerous than that from below; (3) when it is easier, and (4) when more radical. None of these is reached by this method. Even the late results are not better. In man it is more difficult because of the smaller pelvis; in woman much easier, but exactly for this reason is the attack on a high cancer from below easier in her case. The opening of the abdomen is adopted only when a high ligature tears out, the vessel retracts, and uncontrollable hæmorrhage results. Thus teaches Hochenegg's great amount of rectal material.

Small single cancers of the rectum or sigmoid are symptomless and are not discovered until obstructive symptoms appear. They are then crowded down to within reach of the sacral route. The slightest loss of blood is of suspicious significance.

POPPERT.—The mortality is not influenced by the form of anastomosis nor by sacrificing the sphincter so much as has been supposed. Neither is the claim correct that

attempts at anastomosis are a mistake. He has few resulting fistulas. Gersuny's twisting of the gut or Witzel's muscular gluteal anus is a sorry substitute for the natural sphincter.

HACKENBRUCH recommends excision under spinal anæsthesia.

MEYER.—Chief danger is length of time. Depage does a resection of sacrum after Bardenheuer and draws the stump down without suture, in half an hour. In the prone (head down) position the region is most accessible, better to be seen, bleeding less, and narcosis good, a position to be recommended in all operations on these parts.

KÜSTER prefers operation in two sittings in all cases where possible, and often uses lumbar anæsthesia.

BRAUN for a cancer of the lowest colon had first made an artificial anus and then a resection by Murphy button.

SCHLANGE considers it very rare where one can not reach the growth from above alone or below alone. When it can be felt from below it can so be removed. He recommends the making of an artificial anus, not a fecal fistula, rather high, and eight to fourteen days later removes the growth. Thereby is the operation cleaner and the tumor more movable.

JAFFÉ.—As important as it is to retain the sphincter, it must not be forgotten that implantation recurrences are very apt to appear in the rectum; they prefer that field.

KÖNIG has abandoned this operation for cancer but considers it admirable for rectal syphilis which cannot otherwise be saved from fistula.

KRASKE.—The belief that the sphincter action was damaged in the sacral route was a mistake. The later closing of an artificial anus he found not so easy.

VII. On the Value of Excision of the Spleen in Banti's Disease (Enlargement of the Spleen with Sclerosis of the Splenic Vein, Anæmia, Ascites, Liver Cirrhosis). JAFFÉ (Posen).—It is important to remember that the spleen

enlargement precedes these other symptoms by some time. The ascites is an independent symptom and its removal is more than a symptomatic therapy but of much influence. The belief is growing that the liver cirrhosis is a sort of wandering of the disease, and also that the splenic enlargement and the ascites are not obstructive symptoms. A part of the enlargement is due to an active process in the spleen (and liver).

Jaffé operated in an advanced stage of enormous ascites where no improvement was expected and had exceptional results, possibly a cure. This, in spite of advanced liver cirrhosis proven at the operation. So in certain forms of liver cirrhosis splenectomy is to be used in combination with Talma's operation (sewing the omentum to the parietes). (The latter works more no doubt by influencing the serosa than by establishing collateral tracts.)

VIII. On Plastic Operations on the Gall Tract. VON STUBENRAUCH (Munich).—A man had suffered for a year from a bile fistula established for choledochusstenosis from chronic pancreatitis. The pancreatic swelling did not subside, so the fistula became permanent. A cystenterostomy or cystogastrostomy was not feasible, so Stubenrauch prepared a flap of sero-musculo-mucous tissue "with upper base cut from the pyloric portion of the stomach and duodenum. This was rotated 180° and the serous surface applied to the choledochus defect, the mucous membrane sewed to the mucous edge of the little gall-bladder, and finally the stomach and duodenum firmly sewed to the base of the flap, saving a little pucker for drainage." The patient is completely cured of complete fistula with hernia.

On animals he demonstrates similar procedures. They are to be employed where the typical operations are impossible.

IX. Cure of Pancreas Rupture. BLECHER (Brandenburg).—A man received a blow from a hoof on the stomach. The next day gradual loss of strength, pain

in epigastrium, much vomiting. On the fourth day much anæmia, no effusion in abdomen, no peritonitis, indistinct resistance in epigastrium, dulness size of silver dollar between colon and stomach. Diagnosis of circumscribed hæmorrhage from pancreas. On laparotomy a cavity with blood and clots was found behind the elevated colon. A tear in the back of the pancreas, which was tamponed. Sugar in the urine for three days. Finally, complete cure.

X. On the Cause of Death in Acute Pancreatitis.

DOBERAUER (Prag).—Fat necrosis and a resulting soap-poisoning has heretofore been held as the cause of the frightfully sudden death. Doberauer cannot accept this, but believes death to be due to poisoning from a substance produced in the diseased (obstructed) organ. Fat necrosis is known to heal; and we often find on autopsy or in operation very little fat necrosis. Neither does Doberauer consider peritonitis a cause of death; lack of gross changes, and of bacteria in effusion, in necrosis and in pancreas. It takes longer to kill through septic process.

We must next take refuge in nervous reflex working through shock to the sympathetic. Rapid cases of such are known but they are then caused by severe mechanical insult to the peritoneum. The influence of the acute disease on the general condition, blood and urine, is not sufficient. Investigation of the latter shows it to be little disturbed.

In dogs the pancreas was doubly ligatured and divided with the production of a disease apparently identical with acute pancreatitis in man. If some of this pancreatic tissue was injected into the abdomens of other dogs the disease was reproduced. The injection of fresh and sterile tissue from pancreas not so affected did not affect the subjects. The obstructed pancreas were in no way necrotic, so the intoxication did not come from such source. Tissue from the ligatured spleen produced no effect. Animals immunized by repeated small injections from the mutilated pancreas were then able to withstand the operation of ligating the

pancreas! They were immune, not to pancreatic substance but to poison contained in the inflamed organ.

URINARY ORGANS.

I. Treatment of Intra-Peritoneal Bladder Tears without Bladder Suture. NEUMANN (Mainz).—The results in laparotomy and suture are not good. There is a growing suspicion that the peritonitis which causes death may be caused by operation. Neumann reports a case where suture had to be abandoned because of collapse and was replaced by a tampon the size of the fist. Twenty hours after some urine was passed naturally. Complete cure. The tampons must not be so large as to compromise the bladder.

EXTREMITIES.

I. Socket Resection in Hip-Joint Disease. BARDENHEUER (Cologne).—To determine the condition of the socket he palpates by finger the inner surface of the pelvis, lifting up the psoas. It is usually found to be diseased because of the lateness of the operation and its resection or curettage shortens much the convalescence. It also enables one to reach all the tuberculous tissue. The real shortening is slight and is compensated in the inclination of the pelvis and the abduction of the femur.

The fourth advantage is that the operation prevents the development of adduction-flexion and the wandering of the femur head past the pelvis.

The fifth, that there usually forms a strong movable union (twice in seven a bony union).

Sixth, good function. The dangers are not greater, and when we consider the lamentable results of the incomplete operation, really less. Of course resection of the socket is combined with excision of the head of the femur, etc.

SPRENGEL has repeatedly used this method (Bardenheuer's), but he does not go so far as Bardenheuer, who attacks the socket in relatively early cases. The attack is

too severe. It should be reserved for late cases and the young, not for the old.

II. On the Voluntary Luxation of the Hip-Joint. BRAUN (Göttingen).—Only twenty cases have been reported and this the first operative. The girl can dislocate the hip partly voluntarily by straining certain muscles, or in walking it may occur spontaneously. The luxation is incomplete and outward, and is accompanied by a loud crack and great pain. The unbearable trouble was operated upon after rest, extension and gypsum failed. No cartilaginous antrum was found, leaving the socket shallow. A piece 2 by 5 or 6 cm. was chiselled from the upper hinder edge of the bony socket, displaced downward, and fixed. Plaster of Paris dressing. Primary union. Complete cure after two and one-quarter years. The method is recommended for repeated spontaneous luxation when depending on similar basis.

III. On the Fate of Silver Wire in Open Suture of the Broken Patella. VON BRUNS (Tübingen).—Of twelve cases, in only one was bony union reached without tearing out or breaking. In three cases pieces of wire reached the capsule. Bony union occurred in three cases, but in two more Röntgen examination showed slight separation. The harm from the wire does not reach to compromising the healing. Patients frequently complained of sticking pain. Complete extension usually followed.

KRÖNLEIN is not convinced that the open method is better than the closed.

KÜSTER recommended the percutaneous suture.

RIEDEL recommended the subcutaneous suture with catgut, and with 10 to 12 such the fragments could be very closely lashed together.

VON BRUNS is not satisfied with the results. A good anatomical healing is not identical with good functional cure, and the converse.

BARDENHEUER obtains by extension at least a good fibrous union.

IV. On Bone Implantation. RAUSCH (Schoneberg) demonstrated the largest (up to this time) piece of dead bone implanted in bone and healed. A piece 9 cm. long and the thickness of the whole tibia was obtained from an amputation the day before, boiled and placed in the upper end of the tibia which had been resected for myelogenous sarcoma. Secured to femur and tibia by ivory pegs. Primary union. Nine months later, amputation for recurrence.

The implanted piece had grown fast on both sides, was nourished and covered by new periosteum.

V. On the Rational Ambulant Treatment of Varicose Veins and Ulcers of the Leg. LOSSEN (Frankfort a. M.).—The cause was mostly in the inactivity or weakness of the musculature of the lower extremity. Previous forms of treatment have at most only a temporary result and instead of considering this chief cause one still prescribes rest and elevation. The trouble quickly returns. Instead of weakening still more the musculature through disuse it should be put in condition again by gymnastics, massage, etc. Lossen has treated several smiths without interrupting their work, by showing them ten to twenty times how to do during their work the required gymnastics. After four to six weeks the swelling was gone and the ulcers healed. He has also had good results in the *praxis elegans*.

VI. Osteoplastic Resection of the Tibia and Ankle-Joint. BRODNITZ (Frankfort a. M.).—Adaptable to advanced tuberculosis of the lower third of the tibia and ankle-joint, especially tumors of the lower third of the tibia. Longitudinal incision over tibia and over fibula to the talonavicular joint; connecting the upper ends of these by a bow-shaped incision down to the bones, and the lower ends by an oval incision over the tuberosity of the calcaneus, also to the bones. Oblique division of tibia and fibula by Gigli saw and the calcaneus by a metacarpal saw, the soft parts correspondingly. Shell out the anterior soft parts and adapt the calcaneus to the tibia.

VII. On the Plastic Covering of Exarticulation Stumps. SAMTER (Königsberg i. Pr.).—Both feet of a child were crushed, the soft parts above the malleoli. The malleoli were sawed off, a bridge-shaped flap was made from behind the lower end of the tibia and slid down under the defect like a stirrup. The rest healed by granulation. The result for some time has been good, movable soft parts and a supportive stump.

BOOK REVIEWS.

A TEXT-BOOK OF THE DISEASES OF THE EAR, NOSE AND PHARYNX. By D. B. ST. JOHN ROOSA and BEAMAN DOUGLASS. New York: The Macmillan Company.

This little book is a sort of First Reader on the subject. It is an example of conservative teaching except in one or two places where it seems to buck over the traces to an astounding degree; *e. g.*, "If the bony wall of the sinus is removed, and the membranous wall exposed, no harm results. In fact, this should always be done in order to obtain information about the condition of the interior of the sinus,"—p. 485.

Certain statements should certainly *not* be accepted as true by beginners without personal investigation; *e. g.*, "Its actual value (that of the tuning-fork) in testing the hearing power is chiefly with one tuning-fork, C₂,"—p. 4; "The observer does not look through the opening in the mirror but rather over the rim of it,"—p. 10; "More dependence can be placed upon the appearance of the drum-head and the sensations of the patient than upon the sounds heard through the diagnostic tube,"—p. 37. Later in the book non-dependence on the appearance of the drum-head is especially emphasized; that poulticing is good treatment in either external or middle otitis; "no nasal-spur operation should be left without packing the nasal cavity,"—p. 233; "The best method of treatment is undoubtedly amputation,"—p. 277, for hypertrophy of the faucial tonsil (does not even mention enucleation); in speaking of paracentesis of the drum-head: "The operation when required causes so little pain,"—p. 294; "The diagnostic tube could well be dispensed with in aural practice,"—p. 365; "But the piston syringe, made of metal, is the preferable one for the purpose of removing pus from the ear,"—p. 404; "Fever is present throughout the entire course of mastoid disease,"—p. 462; the description of an operation of opening the mastoid cells without extending the field to the mastoid antrum, p. 475; the recommendation of the use of the

trephine or drill in certain cases of operation on the mastoid, p. 477; the use of the Stacke protector, p. 481.

Certain portions of the book are to be unreservedly commended; such as the description of the causation of the ill-effects constitutionally of mouth breathing, pp. 204-5; the rules for the method of using the nasal douche; the emphasis laid upon the necessity for frequent attention, even daily, by the surgeon in cases of chronic middle-ear suppuration, p. 404.

HENRY A. ALDERTON.

The PRACTICE of GYNÆCOLOGY by EMINENT AUTHORITIES.

Edited by J. WESLEY BOVÉE, M.D., Professor of Gynæcology in George Washington University, Washington, D. C. Octavo, 838 pages. Philadelphia and New York: Lea Brothers & Co., Publishers. 1906.

This work is the first of three companion volumes dealing respectively with Gynæcology, Obstetrics and Pediatrics, and is offered to the profession as a practical treatise on the diseases of the generative organs of women and on those of the neighboring organs, the urinary system and rectum. The work has been written by seven contributors.

J. Wesley Bovée has written the chapters on the Developmental Anomalies of the Female Generative Organs, Sterility, Diseases of the Rectum, Anus and the Urinary Tract; J. Riddle Goffe, Menstruation, Displacements of the Uterus, The Vaginal Method of Operating, and the After Treatment and Complications of Abdominal Operations; G. Brown Miller, Uterine Conditions; George H. Noble, Fistulæ, Lacerations of the Perineum and Diseases of the Vulva and Vagina; Benjamin R. Schanck, Diseases of the Tubes and Ovaries exclusive of Infections and Tubal Pregnancy; Thomas J. Watkins, Infections of the Tubes and Ovaries; X. O. Werder, The Examination of Pelvic Contents, The Technique of Abdominal Operations and Extrauterine Pregnancy.

Pathology and bacteriology have been chosen as the chief guides in the classifications of diseases. The classification of endometritis by Miller on this basis seems most rational. He regards only those cases which show actual inflammation as endometritis and does not apply the term loosely to the hypertro-

phies and other changes in the endometrium due to misplacements, pelvic tumors, etc. As bacteria are the cause of uterine inflammation in the vast majority of the instances, he considers endometritis and metritis as some stage of infection, either acute or chronic. He therefore classifies them according to the various agents infecting the genital tract: (1) gonorrhœal, (2) those conditions caused by pyogenic or saprophytic bacteria (essentially a wound infection), and (3) tuberculosis.

The feature which particularly recommends the book is that the latest ideas in each branch of the subject are presented as exhaustively as the scope of the work permits by one especially interested in that branch.

JOHN A. SAMPSON.

A TREATISE ON SURGERY. By GEORGE RYERSON FOWLER, M.D., Brooklyn, New York City, Examiner in Surgery, Board of Medical Examiners of the Regents of the University of the State of New York, etc. 2 vols., royal 8vo. Philadelphia and London: W. B. Saunders Company, 1906.

There are two points of view from which we may regard a new treatise on surgery. It is the record and exposition of the learning of the author and his ability as a teacher, but it is also a history of his own achievements in his chosen work and a record of what he himself has done to further the science and art of surgery.

The author of this treatise has finished his work. He has laid down pen and scalpel and sleeps in his final repose under the greensward on the edge of the busy city whose people he served so well. He never saw a printed copy of his book. Death overtook him almost at the desk, as his hand wrote the finishing lines of his last work, and seizing his pen wrote for him on the clear record of his life, "Finis." And so he slept.

Dr. Fowler's habit of thought, his incessant and superabundant energy which drove him to work, as Jehu drove, furiously, unfitted him for the cloistered recesses of the laboratory and the quiet routine of research work. His nature kept him on the firing line, in immediate conflict with the forces of disease, so he sought out for his life task the most exacting and exhausting work of the profession, the practice of surgery. When he was not actually at work over the operating-table, he was at his desk, and

when he was not at work he was asleep. It was impossible for his restless mind to be idle. His treatise on surgery is his gift to the profession, his farewell and his monument.

As we glance through the pages of the work we are constantly reminded of the man. Dr. Fowler was a student of the world. No pent up Utica restrained his powers or activities. He was not satisfied with the literature of his native tongue nor with such reading as his limited time allowed him from the world's literature, so he kept himself informed through correspondents in Europe whom he paid to forward to him at once everything of importance which went on in the European clinics. He was thus often cognizant of continental methods long before the published accounts appeared in the journals. He was also a familiar figure at most of the great clinics abroad, whither he journeyed not for rest but rather instruction and the amplification of his powers. As a teacher his years of experience fitted him in a peculiar manner to write a successful work on surgery. He knew wherein men failed. He had probed the weaknesses of the graduate student for many years, nor had he read hundreds of examination papers without appreciating the value of conciseness and exact statement. His book is the epitome of his life. No one can peruse its pages without being impressed with the wide learning of the author. It has become fashionable nowadays to edit a work on medicine or surgery in which the work of the editor is largely that of supervision, the successive chapters being written by different men. Such works are termed "Systems," and are often notable for the unevenness of their quality. Dr. Fowler however has put into these pages the record of his life of work and study with little aid from other men. It is distinctly Fowler's Surgery and not an edited compilation. The work is a marvel of condensation. There is little rhetoric and no useless verbiage. Every sentence tells its story, either to recount a fact or give instruction as to treatment. The first volume, as the author states in his preface, contains an exposition of the "fundamental principles underlying what is known as the science of surgery." Chapters on inflammation coupled with a chapter on surgical bacteriology give the student the basic facts which relate to acute and chronic tissue changes dependent on the various infections. The chapter on laboratory aids to surgical diagnosis is invaluable and contains the most recent

methods in hæmatology, urinology and kindred subjects. Chapters on general surgical considerations, common and special dangers incident to operations and postoperative complications point out to the student the various pitfalls and snares in surgical work. The chapter on operative procedures is an epitome of operative surgery. A chapter on the regional surgery of the head and thorax concludes the first volume. Of special interest is Dr. Fowler's account of total pleurectomy, an operation which he originated and first performed October 27, 1893. The second volume largely contains the results of the author's personal work, and consists in a description of the regional surgery of the body with the exception of the chapter in the first volume already noted.

Among operations which Dr. Fowler originated or modified may be mentioned the following: Protopexy, for total prolapse of the rectum; ventrosuspension of the uterus by means of the urachus; a combined catgut and cautery operation for hemorrhoids; intraperitoneal displacement of the cord, a modification of the Bassini operation for hernia; ureterorectal transplantation of the ureters for exstrophy of the bladder with valve formation to prevent ascending infection. The chapter on hernia is of great excellence. The chapter on the surgery of the prostate contains an account of all the more recent work which has been done in this important field. The chapter on operations on the pelvic organs is as complete as considerations of space permit in a two-volume work. The volume closes with the injuries and diseases of the extremities, including fractures and dislocations. The author devoted most of his spare time for the last fifteen years of his life to the completion of this work. It is his book, the record of his experience, a summary of his life work. Those of us whose privilege it was to be his associates will ever read its pages with affection and respect. We shall be reminded of his eagerness for work, of his boyish enthusiasm, his pleasure and happiness in the success of his own pupils and former assistants. He had no mean jealousies. He was always ready with advice, congratulation, encouragement. We have lost our master and our friend.

ALGERNON THOMAS BRISTOW.

CARR'S PEDIATRICS. THE PRACTICE OF PEDIATRICS BY EMINENT AUTHORITIES. Edited by WALTER LESTER CARR, M.D. Octavo, 1014 pages. Philadelphia and New York: Lea Brothers & Co. 1906.

The Practitioner's Library, published by Lea Brothers & Co., is composed of three companion volumes covering, respectively, Gynecology, Obstetrics, and Pediatrics, each edited by a clinician and teacher of wide experience, bringing together in three volumes the opinions of well-known authorities in America and England upon selected subjects assigned to them by the editor.

In the volume on Pediatrics, the author gives his own observations of a disease and the therapeutic measures which have resulted in the greatest success, giving to each contribution a personal element which is of great value to the reader. All of the writers emphasize first the clinical picture of the disease and then the best method of treatment.

The treatise is illustrated throughout by most excellent colored plates and photographs, and the subject matter is so arranged as to make any special subject readily accessible to the reader. Historical digressions and discussions of unproven theories have fortunately been omitted. Pathology has been somewhat slighted in order to give more prominence to symptomatology and treatment. Considerable space is allotted to infant feeding, diseases of the alimentary tract, disorders of nutrition, respiration and circulation, emphasizing those conditions associated with disease in children.

The work is divided into twelve sections: Section I, Diseases and Injuries of the New-Born, by Edward P. Davis, M.D.; Section II, Development, Growth and Hygiene, by Leroy M. Yale, M.D.; Section III, Infant Feeding, by Thomas S. Southworth; the remaining sections treat separately of the diseases of the various tissues and organs of the body. The section on the Diseases of the Alimentary Tract, by David Bovaird, is especially commendable. The section on Infectious Diseases is divided among a number of eminent authorities.

The book, as a guide to the practitioner, is most satisfactory, and throughout is a clear and practical treatise on Pediatrics.

PAUL PILCHER.

CORRESPONDENCE.

REMARK UPON THE ARTICLE OF DR. CARLETON P. FLINT: "A NEW METHOD OF EXCISION OF THE KNEE WITHOUT OPENING THE JOINT," IN THE ANNALS OF SURGERY, MARCH, 1906.

EDITOR ANNALS OF SURGERY:

The "new" method described in the article mentioned in the title, in respect to its technical execution apart from single details as well as the aim which the author intends to reach, is essentially the same extracapsular method (*extracapsuläre Methode*) which I proposed long ago.

I gave the description of this method first in Russian, in the journal *Wratch*, 1896, No. 31, in an article entitled "So-called Extracapsular Method of the Excision of the Knee, and lately, in the year 1904, in the *Deutsche Zeitschrift für Chirurgie*, bd. 74, in the article "Zur Frage der operativen Behandlung der Tuberculose der grossen Gelenke der Extremitäten und speciell der Resection derselben." To this last treatise, which shows at the same time that the extracapsular excision is also applicable to other joints in case of tuberculosis, I refer Dr. Flint in order to acquaint him with my opinion on this question.

In general, I can only greet with pleasure the further appearance of a completely independent proposal of the extracapsular excision of the joint (*resp.*, without opening it) as the best proof of the inexpediency—at least in many cases—of the usually employed innerjoint excision, which reveals itself more and more.

NICHOLAS WALKOWITCH,
Professor of Surgery at Kiew, Russia.